THE IMPROVEMENT

OF THE

HEALTH OF CHILDREN AND ADULTS BY NATURAL MEANS.

INCLUDING

A HISTORY OF FOOD

AND A

CONSIDERATION OF ITS SUBSTANTIAL QUALITIES.

BY

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PREFACE.

The principal object of this work is to present to the public intelligible information, deduced from well-determined facts, upon the best means adapted for the improvement of the physical condition of delicate children, and for the maintenance through life of a tolerable condition of good health.

To render this information as comprehensible as possible, the book opens with a premise of the various unfavorable influences that tend to the enervation of the physical powers of parents; and this is followed by an outline of man's organization, development, and proper sustenance, and by an elucidation of the relations which exist between the vegetable and animal kingdoms, whence his subsistence is obtained.

In treating of these, the author has, in addition to the recital of his practical experience, availed himself of the most favorably noted publications on physiology and chemistry, simplifying their language in the hope of being thus able to facilitate a profitable perusal by the unscientific reader, and to induce him to make practical application of those modern discoveries that tend to the improvement of his physical condition.

Private hygiene claims a more general consideration than is usually given it by families and individuals; for the maintenance of a good normal state of health is

possible if a proper knowledge of the subject is acquired. Therefore, to this end, much labor has been expended in the selection of the reliable information which will be found in these pages. This work, however, is not intended to supplant the invaluable services of experienced physicians and surgeons, whose skill must be relied on in arresting the encroachments of disease. It is designed wholly as an index to the best means of improving the physical condition of our degenerating race, by pointing out to the heads of families and individuals the prudential practice that will tend most directly to the increase and maintenance of vital or living force, so as to enable it to resist the influences of unavoidable contingencies inimical to health.

To avoid as much as possible the tedium of dry, didactic reading, interesting historical incidents, relating more directly to the food of man, have been somewhat freely interspersed through some of the chapters; and information, which can not fail to be of use, is given upon the most improved means of preserving food in a wholesome form for consumption at times when it can not readily be obtained fresh; while it terminates with a few practical remarks on air, temperature, bathing, exercise, and clothing, and with instructions in the means of arresting bleeding from accidental causes, and in the most effectual methods of restoring suspended animation. In a word, an effort has been made to present, in as compact yet complete a form as possible, important information that, if heeded, will obviate many of the ills of life to which the human family is constantly exposed.

NEW-YORK, May, 1868.

Second Edition.

The very favorable reception of the first edition of this work, and a renewed demand for copies, induced the publishers to advise the author to permit them to publish a second edition in a more acceptable form than the first. To their suggestion we have consented, being impressed with a desire to tender the heads of families, for the benefit of their children, the result of our professional experience for over thirty years, and of our special work during the past eleven years, in the supervision of the treatment of over 30,000 patients, in the "Hospital for the Relief of the Ruptured and Crippled," where children from the age of four to that of fourteen, laboring mainly under constitutional chronic disease, are received for treatment. Careful observation of their history, and that of their families, clearly confirms the opinion, that timely care under judicious home influence would have greatly modified, if not in many instances prevented or arrested, the progress of much suffering for the patients, and distress of their parents and friends. This book is intended to impart important information upon this subject.

March, 1875.

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PART I.

A Premise on Man's Health.

CHAPTER I.

PHYSICAL TRAINING CONDUCIVE TO HEALTH.

The Condition of Man's Health viewed comparatively—Improvement in the physical condition of man's offspring an obligatory duty—Sickness the great subduer of man—The entailment of disease upon our offspring a sad reflection—The enforcement of laws and dogmas by the ancients to the advantage of their children—The beneficial influence of muscular exercise common to both sexes—Encroachment of new diseases—Mental attainment not incompatible with means for physical development—Children can only be improved in proportion to home influences—The organs of the system that suffer most from mental perturbation—The most common ailment, Dyspepsia, a monster malady of Protean form

IN order to ascertain what is most conducive to the improvement of man's health, it is absolutely necessary that we should investigate his normal condition, and discover the agencies that are most instrumental in impairing it. The full development of the organization, the complete performance of all the organic functions, and the enjoyment of an agreeable condition, may be considered as approximating to that desirable state of existence—perfect health. Dr. SOUTHWOOD SMITH, in his "Philosophy of Health," defines the same "as the natural and easy exercise of

all the functions—constituting a state of actual pleasure;" in which case, he adds, "the usual, the permanent, and natural condition of each organ, and of the entire system, is pleasurable." Dr. JAMES JOHNSON states that "this might be true if we were in a state of nature; but, in our present condition, there is scarcely such a thing as perfect health." Unfortunately, however, perfect health is often a negative rather than a positive quality—an immunity from suffering rather than the "pleasurable" condition described by Dr. SMITH. All experienced medical writers incline to this conclusion with regard to the health of man in his present situation. Hence, his offspring must be considered as in a comparative state of health, for "the sins of the father are visited upon the children." The infant brings with it predispositions to disease peculiar to the parents, which are developed in its progress through life, modified or aggravated, as circumstances may determine. Great improvement, however, in the health of the offspring, may be obtained by careful training, which is an obligatory duty enjoined upon parents; for they have assumed a responsibility not to be avoided under any pretence, other than that of physical or mental inability. It is a responsibility due, not only to the child, but to that Creator who has blessed them with a likeness of themselves, in a living being, and implanted in their hearts that deep love which is only fully realized when the child is afflicted with pain, and the hand of death is upon it.

We are all aware that wealth can not procure health and ease, much less happiness or life. It would be

considered an unjust dispensation of Providence to have permitted the *purchase* of that which is the poor man's joy—good health—the want of which reduces the affluent to worse than indigence. The bed of sickness and suffering is the greatest subduer upon this side of the grave. If properly considered, it affords us consolation to know that the affliction is for our good, although it may have resulted from our own indiscretion ; but it can not be made a consolation to the parent who has entailed suffering upon his offspring, either by neglect or ignorance of what is most conducive to their welfare.

It is universally admitted that there is a degeneracy of physical power in our race at the present day, compared with that of the ancients, which should invite our attention to the means successfully adopted by the latter to develop energy and strength. Their method of enforcing hygienic training would most certainly not be applicable in this enlightened age, but it serves to awaken the inventive genius of our advanced intellect. The religious ceremonies of the ancients had a most potent influence in the preservation of health. In the observance thereof they were very strict, and it was a part of their belief that their sanitary code was the mandate of Heaven. Hence, Brahma had no difficulty in introducing the vegetarian doctrine. He prohibited the use of animal food, and was most rigidly obeyed by all his adherents, much to their advantage in health, as they lived in a very hot climate. It was the same with the Hebrews, who were forbidden to eat pork, an observance to which they strictly adhered, believing it to be a divine command. The

abstinence therefrom was of much benefit to them, because, in the eastern country which they inhabited, the swine were afflicted with the leprosy, a supposed contagious disease of most loathsome character, that could be communicated to man. Lycurgus, too, made a law for the guidance of the Greeks, in which it was decreed that all children born with deformity or defect should be destroyed. Its object was to preserve and improve the form and physical capacity of the Spartan children, so that he could rely upon them, when they reached man's estate, as protectors of his government. And that their well-formed muscles might be invigorated and attain extraordinary strength, he introduced physical training as essential to both sexes, and thus produced a stalwart race. No attempt at educating the mental faculties, or restraining the exuberant spirits of these Spartan children, was allowed before the expiration of the first seven years; consequently, the full energies of the system were expended in the development of the physical frame. When seven years old, both mental and physical training were enforced by the laws of the country. Under these laws the children were subjected to a regular course of discipline in public, and in common were exposed to atmospheric changes of every kind, and were compelled to undergo severe exercises in the gymnasium, the practice of which increased with their age. At the same time, their diet was very simple, and but little varied.

This rigid system of training both the sexes before marriage must have produced that great similarity of constitution, as well as that vigor of health, which

is at the present time exhibited in our rural districts, where women work in the field with men. In some German settlements, the female is quite equal in muscular force to the male, possessing sufficient strength to shoulder three bushels of wheat, (sixty pounds to the bushel,) and to throw the load upon a horse, preparatory to taking it to the mill to be ground into flour. How many men are there in our large cities who could accomplish this feat? Not one out of ten. Such strength may not be required for the ordinary pursuits of life, yet it is of great value to the possessor, as it is a protection against the vicissitudes of our climate. It also tends to mitigate maternal suffering, as is evinced in the districts alluded to, where women engaged in rural pursuits are not, in many instances, confined to their beds more than twelve hours. These well-known facts ought to be sufficient to induce us to make at least an effort to improve our physical constitution.

We thus find that the ancients enforced sanitary measures both by religious dogmas and by legislative enactments, and thereby produced nations of the most healthy and hardy races of men that ever lived. A knowledge of this truth shows our deficiency in public sanitary measures for the protection of the health and the lives of our people, who suffer from increasing deterioration of their physical powers, and from the encroachment of new diseases, which are frequently pronounced by practitioners in medicine to be of an extraordinary type, and entitled to new names. Our condition is, consequently, truly alarming, and the attention of the people should be invited to the sub-

ject, so that it may be corrected by a united effort, which can only be made when the public are fully aware of their situation. Religious dogmas, it is true, would not be tolerated at the present time; neither would legislative encroachment upon the prerogatives of the heads of families be submitted to. The consideration of this all-important topic must, therefore, be left with the enlightened and educated classes, whose example would surely be followed. If they, for instance, prevented their children, during the first seven years of life, being confined for unreasonable hours in school, limited them to a simple and nutritious diet, caused them to take daily exercise in the open air, enforced little or no restraint other than moral instruction, and clothed them in a dress that would permit freedom of muscular motion, their wise example would, in a reasonable time, become popular and be of great advantage to the health and pleasure of the young, who are ever ready to test their agility and muscular energy with their companions. Trials of activity and strength were the delight of the Spartan youth; and athletic sports still form part of the inherent disposition of the young, and are to them pleasurable pursuits which invigorate both the mental and physical powers. Such exercises, however, to have a beneficial effect, must be carefully regulated by stated periods of rest, determined by powers of endurance and predisposition to constitutional weakness; and, by good management, such predisposition may be much improved, and attain power to resist the influence of ordinary surrounding circumstances prejudicial to health. It must be borne in

mind that the Spartan children were kept on plain nourishing food, and were not submitted to any restraint for the first seven years; and that after that age a gradual training, regulated by legislative enactments as to the exercises, which were uniform and severe, tended to develop muscular power without injury from its severity. These children had no constitutional derangement nor hereditary weakness; for their parents, having experienced a similar course of treatment in their youth, were vigorous and healthy, and transmitted their hardy organic tendencies to their offspring.

Though the Spartan children were mainly trained for the development of muscular power, mental education is not incompatible with such exercises, if not too excessive. But, in viewing the advantages to be obtained from physical training, properly balanced by moral and mental culture, we perceive many seemingly almost insurmountable difficulties that supervene, discouraging alike to teachers of schools and to those who have the responsibility of taking charge of our children. After laboring most assiduously, yet unsuccessfully, for the improvement of youth, they are unable to account for their want of success, the reason for which is attributable to their being unacquainted with the former habits of the children, a knowledge whereof would throw much light upon the subject. The irregularities or intemperance of parents, in regard to the ordinary government of many families in fashionable life, is very apparently manifested in their children by an obtuseness of nervous sensibility, which nervous condition is caused by excessive

indulgence in extraordinary excitements. Such children can only be improved in proportion to the extent of home influences brought to bear upon them, unless they are placed under the exclusive charge of judicious teachers. The only means of accomplishing this result is in early life, by a systematic and vigorously enforced course, which, if adopted, will improve their mental and physical powers, and often rescue them from latent morbid tendencies.

It is to a knowledge and just appreciation of these facts that we are most desirous of drawing attention, in the hope that they will induce parents who subject themselves to pernicious influences to have, at least, regard for their children, and thus save them from the inevitable result of such conduct—ill health. The relation between the mental and physical forces of the system is so close that excesses in the latter seriously impair the former, and excesses in the former still more seriously impair the latter. For instance, too much mental exertion at any period of life is inimical to health. Those engaged in scientific, mechanical, mercantile, political, or other pursuits requiring great mental exercise, naturally experience physical disability. But the depressing passions consequent upon failure, an exalted condition of the mind created by great excitement, and a morbid tendency to excitability, which may be prompted by a desire to imitate others who indulge in constant excitement, are most injurious of all. These present examples of intemperance of the most insidious character, which manifests itself in encroachments upon the necessities requisite to the maintenance of good health,—in the

rejection of food of a proper kind at stated times, and in the loss of sleep at the proper period for rest, or in taking too much sleep at irregular hours. And it is these encroachments, added to excessive nervous excitement, that is deteriorating the constitution of man, and is giving us, at the present day, a weak, degenerate race. An occasional freak of over-indulgence produces no permanent injury, and may even be repeated at long intervals with seeming impunity; but we may rest assured that a continuance of such action will always affect the person so indulging in proportion to the stamina he possesses. Hence, we find some people persisting in these habits with apparent impunity, whilst others suffer severely for their temerity.

We probably more directly observe the influence of the mind upon the body, when it is caused by unavoidable and unfavorable circumstances, than when it is occasioned by indulgence in what is most exuberant to our tastes, such as in ambitious designs, in hilarity, or in gazing upon scenes that are astonishing and exalting to the imagination. Here is an illustration. A man receives astounding intelligence of some most distressing character. His mind, his brain, his whole nervous system are agitated and disturbed; his appetite fails, or, if he partakes of food, it is not properly digested; fever supervenes, and his whole frame indicates a depressing influence. It is remarked, from an actual change in his features, that he appears older than he really is. In a word, the organs not immediately under the control of the will, or not directly connected with the intellectual portion of the body,

—the organs of digestion, circulation, nutrition, and secretion,—are all disturbed, and their functions disordered.

The mental effects upon the corporeal system are those which naturally attract most attention. Very few, comparatively speaking, are exempt from trouble. From the laborer, who is most probably the least afflicted, to the millionaire, all have their grievances. There is, consequently, to be found in every rank of society a depression of the nervous system, which tends to produce debility, and to induce a gradual failure of the physical organization to perform its wonted functions. This depression is followed by various types of disease, which can only be palliated for a time by the skill of a physician, whilst the evil is continued. The most common ailment is *dyspepsia*, a disorder of not very distant origin, which Dr. JOHNSON calls a "monster malady of Protean form." No mention is made of dyspepsia in ancient records, nor was it even known in the middle ages. It is, doubtless, the offspring of civilization and refinement, of sedentary habits and intellectual culture, of physical deterioration and mental perturbation—a Proteus which assumes the form and usurps the attributes of almost every malady, mental and corporeal, that has scourged the human race since the creation of the world. The physician, pressed for an explanation of this malady, quiets his patient by saying that it is a nervous derangement, or the result of a diseased liver, stomach, spleen, brain, or spine. But he must not call it hypochondriasis or hysteria, for by so doing he would give offense, and probably

be discharged from further attendance. Dr. JOHNSON states that it is not difficult to discover the clue to the diversity of opinion which exists with regard to dyspepsia. This *Patho-Protean* affliction is not, perhaps, in strict language, an entity, a single disease sent down from heaven or springing from the bowels of the earth, but rather a morbid CONSTITUTION or DISPOSITION, produced by the various moral and physical causes we have alluded to, and moulding numerous other maladies into its own semblance. Although the multitudinous causes of this evil must operate in a variety of ways, yet there are two principal channels through which it flows upon man much more frequently than through others—namely, the brain and the stomach, but chiefly the former. The moral impression on the brain and nerves is infinitely more injurious than the physical effect of food and drink upon the stomach, however improper such aliment might be. The multifarious relations of MAN with the world around him, in the present era of social life, are such as must inevitably keep up a constant source of perturbation, if not irritation. This trouble of mind is not solely, or even principally, expended on the brain and nerves, but upon the organs of the body most intimately associated with the brain, —upon the DIGESTIVE ORGANS, including the stomach, the liver, and the bowels.

CHAPTER II.

DANGERS ATTENDING UNDUE MENTAL EXCITEMENT.

Influence of the mind upon the physical organization of man—The dire effects of political excitement; they are increased by alcoholic drinks—The children of politicians predisposed to scrofula—Torture endured by scrofulous children from adventurous treatment—Scrofula curable in succeeding generations—The means of alleviating physical suffering—Deteriorating influences on children, and most serious effects produced thereby.

THE play of the mind upon the physical organization of man, of which we spoke in the previous chapter, has received special attention from some of our most erudite medical writers, especially from Dr. JOHNSON. We have no desire to frighten our political aspirants, but we can not refrain from quoting from that acknowledged eminent authority what he has stated as a part of his experience.

He writes: "During the French Revolution whole classes of diseases were produced, and especially that of the heart. These are now rapidly multiplying from the excitement of politics. Excitement is a word not sufficiently expressive. The *hatred* which exists now between people of different politics is such, that health is incompatible with its continuance. One half of the present violent politicians will as-

suredly die of disease of the heart, or of some great internal organ. Scarcely a day — even an hour — passes without my seeing exemplifications of this principle. If the votaries of political ambition could see with me a few of the effects of that ambition—or, even of that perturbation of mind attendant on political struggles—they would fly in dismay from the baleful contest."

This portrays a great similarity to what is constantly being enacted in our political contests — hatred, envy, and turbulent manifestations, not unfrequently terminating in the loss of life. These contests are sustained by whole classes of political opponents for years ; but, near the close of each election, the most violent perturbations of mind, incited by alcoholic drinks, are experienced, and the physical powers suffer from an actual neglect to take food. If what has been stated by one of the most talented and experienced practitioners in the science of medicine that England ever produced be true, the prospects are by no means encouraging as to the certainty of life among our political aspirants, or as to the robust health of their offspring. In such children the scrofulous diathesis will most undoubtedly prevail in all its protean form of ailments. These ailments are not only more insidious and quite as numerous as those produced in adults by dyspepsia, but they exhibit a more decided character to the experienced practitioner. They are: Inflammation of the eyelids and nostrils ; eruptions of the skin, varying from roughness to that of decided pustules ; secreting incrustations ; engorgement of the glands, frequently suppu-

rating and discharging from the internal ear and under the jaws, known as *King's Evil*; engorgement of the glands of the bowels, producing an enlargement and hardness of the abdomen, which tends to a constant looseness of the bowels; emaciated limbs; humpback; white swelling; and tubercular consumption.

Many children, having a decided scrofulous tendency, are largely developed and exceedingly rotund in form. These, from unfavorable influences, are eventually affected with some of the above ailments, and thus show their defective organization. Such children are usually late in teething, and are subject to enlargement of the joints, to bow legs, and to irregular development of the chest and head. If they enjoy fair digestive powers, and are not placed under the old starving course of treatment, many of them will maintain sufficient vital force to withstand an incredible amount of torture, such as they would suffer from extending by mechanical force their contracted muscles morbidly affected by local irritation, from violent movement periodically applied to enfeebled limbs, from sudden crushing of distorted joints, and from tearing of the ligamentous attachments, and attempting to keep a limb in position where there is no sustaining socket to retain it, the result of which is extensive abscesses. In such cases the patient may escape, and live for several years.

Here we have an important matter for consideration, namely, that a patient is able to endure what would be considered sufficient cause to impair the health of a hale person. It is reasonable to suppose

that, by careful hygienic treatment, many of these ailments would be modified, and this horrible suffering from adventurous treatment thereby avoided. For, if the patients have sufficient stamina to withstand such an exhausting ordeal, is it not a probable inference that they might be restored to a standard of health that would throw off much of the scrofulous taint, which is nothing more than an enfeebled condition of certain organs that fail to fully perform their wonted functions? *Their* offspring would not then be subjected to this supposed hereditary malady, and consequently would not be exposed to treatment like that which we have described.

Scrofula is curable in succeeding generations. It is readily induced in one generation, by depressing influences upon the human system, and from various causes which it requires the utmost care to avoid. And this avoidance can only be accomplished by a knowledge of the human economy in its physical, intellectual, and moral relations. It must be admitted, in this enlightened age, that the study of man is most important. To acquire a knowledge of our own nature, and of the circumstances which surround us, is not only interesting, but the possession of such information enables us to escape much unnecessary suffering. The subject must be considered not in one particular alone, but in all; the intellect, the body, the feelings, and the affections—all must be studied and appreciated, severally and collectively. Many of the grievous ills which mark our course through life must be ascribed to defective education, to deteriorating circumstances, and to want of determina-

tion on the part of parents to maintain a restrictive government over themselves and their children. The greatest barriers to the improvement of the human race are selfishness, jarring interests, and conflicting opinions, together with too low an estimate of the dignity of human nature.

It is the duty of every lover of his fellow-man to strive to ameliorate pain. The starting-point toward the alleviation of physical suffering is a close study of the laws which govern our organization; for, if these laws are violated, we can not hope for a continuance of good health. Many of the ailments to which we are subject in childhood may be mitigated, even where it is impossible to prevent the development of the disease. Hence, it should be understood that we have power, at least, by hygienic treatment, to control many maladies of ordinary occurrence; and this should be forcibly impressed upon the minds of parents, so that by their own efforts they may mitigate a vast amount of suffering to which their children are predisposed.

The tender and sensitive nerves of the young can not be exposed to extraordinary excitement without sustaining injury from over tension. Their sensibility for acquiring the more sedate essentials to intellectual improvement thereby becomes impaired, and an unfavorable impression is imparted to the physical organization; whilst an inability to resist unfavorable influences, antagonistic to their vital energies, is also produced, which influences, under unimpaired constitutions, are overcome as they advance in age. But this good result can only be obtained by individuals

who have been placed under proper *régime* in early life, and are exempt from hereditary infirmities. To accomplish it, careful training in mental and physical exercises—rather restricting the mental so that the physical may be more fully developed—is necessary, especially during the first seven years of childhood. Much care should also be taken to guard against sudden changes of the weather, and against wearing too heavy clothing at one time, and an insufficiency of apparel at another. Great precaution, too, is required to preserve children of this tender age from witnessing exciting scenes, such as those which create an apprehension of danger or lead to great exaltation of the mind, and which are ofttimes enacted at places of public amusement in our large cities; even music in excess, as, for example, extraordinary performances thereof, is injurious. These influences are hurtful in degree even to mature growth and development; for inadvertance of the nature alluded to has entailed timidity upon individuals through life, and has caused the grossest superstitions to be entertained even against the person's own reasoning. The recital of frightfully portrayed scenes is also equally pernicious to youth. It is well known that sudden fear produces upon the human system the most painful sensations of all the depressing influences that affect the mind, and sometimes causes instant death; whilst timidity, in its continued or chronic form, gradually impairs the physical powers, and dwarfs the development of intellect and energy, if not also of stature.

CHAPTER III.

IMPORTANCE OF PROPER HYGIENIC REGULATIONS.

Means of obviating unfavorable influences—Careful family nurture can diminish the virulence of scrofula—The prosperous laborer is blessed with the most numerous and healthy family of children—The advance of knowledge, when properly applied, of great advantage to the laboring classes—Unfavorable circumstances that continue to surround the indigent laborer—How to remove them.

IN order to obviate the influences of hereditary physical infirmities, careful hygienic training must be commenced at birth. When both parents are unhealthy, the offspring can not be sound. The union of many unfavorable circumstances tends to that result. Careful culture will do much to modify, as irregularity will assuredly aggravate, the consequences of a faulty organization. Thus it is that many enjoy tolerable health, in whom latent disease awaits only a suitable excitant; but this latent disease may never be developed, from the disposition being so modified by prudent nurture when young, that it is not easily excited into activity in after life. On the other hand, children of the most healthy parents become delicate in consequence of unfavorable circum-

stances—from improper regulations with regard to air, exercise, food, and clothing, and from depressing moral influences. Children, like plants, require the light and heat of the sun, otherwise they languish and deteriorate. Their digestive powers are weakened by an insufficiency of nutritious food, and by fluids containing little or no nourishment. Foul air retained in rooms from necessity, or from an apprehension of catching cold by the admission of fresh air, also tends to impair the digestive organs. The same result likewise ensues from the want of exercise, caused by children being prohibited from participating in supposed rude or boisterous enjoyments, which are essential to the development of the body, though, perhaps, they are not in strict accordance with the rules of what is considered good deportment.

The effect of this mistaken care is a weakened organization, which, if not apparently developed in the person submitted to over-watchfulness, will exhibit itself in his or her progeny. Scrofula, rickets, mesenteric and pulmonary consumption, caries of the spine or humpback, hip disease, white swelling, and glandular enlargement, terminating in extensive abscesses, as we have already stated, are the attendants which await such a feeble and disordered constitution. It is thus that *imagined hereditary diseases* are induced. If it were otherwise, it would be natural to conclude that they originated with the first parents of mankind, which is certainly not the case. They are, on the contrary, the fruits of our own imprudence. The habits of parents and the manner in which they train their children, can produce or avert these evils, as well

as increase or diminish their virulence. It does not follow that because one or both parents may be the offspring of a scrofulous person or persons, the children, if properly nurtured, will suffer from a strumous predisposition. We have abundant proof of this fact. Persons enjoying the most robust health, and not presenting a scrofulous feature, are the grand-children of those who have been afflicted with hip-disease, caries of the spine, (humpback,) etc. Again, we have others suffering most severely from those diseases, and yet the origin of the disorders can not be traced back even to the third or fourth generation; but, on careful examination, it will be discovered that some deteriorating influence in the parents, or some circumstances pertaining to nurture, have been at fault. Parents of well-developed physical proportions often impair their physical organization by excessive mental exertion and anxiety, or exhaust their powers by extraordinary efforts made in the fascinating and successful pursuit of ambitious designs, either of which will entail an enfeebled progeny. Like consequences also result from irregular habits of living, such as gratifying pursuits during the night, interference with seasonable rest, the disposition to indulge in long repose in the morning, and eating to excess and at irregular periods. These indulgences are unfavorable to the vital forces, which are essential to the production of a vigorous and healthy progeny; and their ill effects are quite apparent in many opulent families of our large cities, the number of whose children who arrive at the age of manhood, or are even born, being very limited when compared with those of mechanics or laborers

whose physical powers are increased in proportion to the force required at their work. Employment in the open air increases both the muscular vigor and the demand for sustenance, which sustenance is relished by the out-door operative with a zest unknown to the epicure, whose palate requires to be pampered with food of an artificial nature; while the former enjoys his simple fare with a relish which the art of cookery can not produce for the latter. The plain diet of the working man serves to raise a numerous and healthy family of children, all other matters being equal, to enjoy the privileges of the liberal mental training which is furnished them by our most invaluable public schools. Where the social amenities of life, with a full knowledge and appreciation of the true source from whence those blessings come, are inculcated to this class of persons, their condition is most delightful and desirable, for they enjoy an almost unsullied happiness; their cares and responsibilities are very limited, and their prospects promising. Energetic on account of their vigorous health, their children are prompted to elevate their position in life, and even aspire to, and actually fill the most honorable stations in the gift of our free country.

It is of great interest to us all that we should fully understand the means whereby the health of mankind can be improved. When we scrutinize the health of those within our cognizance, it is painfully apparent that their organization is almost always defective. Some constitutions yield to circumstances which occasion no change in others. Many persons pass through life in the enjoyment of tolerably good health

and strength, but who, nevertheless, as we have remarked, transmit to their offspring a constitution that yields to morbid influences. The advance of civilization has led to the production of a better supply of the necessaries of life, has tended to lessen the severities of labor, has clothed us with comfortable garments, and given us a sufficiency of food and fuel, and, furthermore, has bestowed upon us medical attendance by skillful practitioners. These are all inestimable blessings which ought materially to better the condition of man. Every thing, as we have fully demonstrated, that diminishes the tendency to disease, alike promotes temperance, cleanliness, and industry, and perfects the organization; while, on the other hand, if a person is exposed to cold or to damp air, or if his labor is excessive and protracted beyond physical endurance, and his food is scanty in supply and bad in quality, grief, wretchedness, and disease are the inevitable consequences. And it should be borne in mind that it is in childhood, especially, that injurious moral and physical agents operate with the greatest force; for it is before the joints are knit and the constitution is fully formed, that the causes heretofore stated produce their most dire effects.

Judging from what is daily presented to our observation, we feel assured that it would contribute much to the improvement of our health, and that it would also redress many of the ills of life, if it were made a part of our general education to convey a knowledge of the structure and functions of the human body, and of the various agents, both beneficial and otherwise, by which we are surrounded from the cradle to the grave.

Such a course would enable many to make a better provision for their wants, both immediate and prospective, as well as open out a multitude of resources which are now overlooked; while the continued operation of superior agencies would effect the most salutary changes in the condition of our race. The state of the very indigent is less encouraging, for they must submit to unfavorable circumstances. The remuneration afforded them for their services is very limited. The amount earned daily by the poor laborer is not more than one half of what the mechanic receives, and not one fourth of the salary paid to the clerk or salesman; hence his inability to procure suitable clothing, sustenance, or habitation. The condition of the poor is truly deplorable; yet adults, when temperate and cleanly in their habits, enjoy fair health. But the arduous labor which persons of this class undergo, together with the want of wholesome diet, efficient clothing, and comfortable abodes, are the common causes which deteriorate their physical powers; and this deterioration is most conspicuous in the health of their children. Scrofulous diathesis prevails; their digestive organs are in an abnormal condition, and are easily impaired by the unwholesome food dealt out to them in our grocery shops; and they are rendered still worse by habitual indulgence at their meals, in large quantities of liquid food, such as soup, weak tea and coffee, and from eating poor bread with a very limited quantity of meat. Still more detrimental to their health is the indulgence, in the summer time, in fruit, which has been rendered poisonous by comparatively long exposure to noxious gases arising from other decomposing

matters, which gases are readily absorbed by all fruit. To illustrate this fact of the absorbing nature of fruit, place some in a drawer with camphor or a lemon, and in a few hours it will be rendered unpalatable. The same influence pertains to vegetables, rendering them very insipid compared with those freshly gathered.

This combination of pernicious influences, constantly operating, morbidly changes all the enfeebled functions; and, in direct ratio to the straitened circumstances of the persons exposed to them, induces chronic disease, caries of the spine, (humpback,) hip disease, white swelling, and other scrofulous affections. A very limited indulgence in eating stale fruit and vegetables, while the system is unfavorably impressed by warm weather and close apartments, produces cholera infantum, which is not unfrequently followed by paralytic seizures of one side—of an arm, a leg, or even of both legs. Irritative fever, from teething, also causes similar effects in enfeebled children, and not unfrequently in children better circumstanced. That unwholesome food is the most prolific cause of cholera infantum has been fully exemplified, especially in institutions where food for the little patients is carefully selected and prepared, and where a sufficiency of fresh fruit and vegetables is given daily during the heat of summer, for under that *régime* they have not only escaped cholera infantum, but have progressed most favorably. This result has been witnessed by the author in the Institution for the Relief of the Ruptured and Crippled, of which he has charge. He has even found the progress, under such treatment, to be more favorable in summer than during the winter season, in consequence

of the patients, from their enfeebled physical powers, requiring more warmth than they would when in ordinary health.

Many scrofulous patients are so weak at first as to be unable either to walk, or, what is worse, to have control of themselves; yet, under these very unfavorable conditions of health, the little sufferers, during the summer months, have had perfect immunity from not only the premonitory symptoms of the fatal disease to which allusion has been made—cholera infantum—but also from analogous ailments, although at the time they have been confined to the house, owing to their very infirm condition not permitting out-door exercises.

The sad truths which we have here related invite reflection in regard to the situation of our industrious day-laborers, who are compelled, by unavoidable circumstances, to submit to their sorrowful position. It is certainly painful to contemplate that there are, in this land of liberty and abundance, the soil of which yields all that is necessary for man's health and happiness, people so sunk in poverty, and doomed to severe labor for a mere pittance. Persons who are more favorably situated can scarcely imagine the consuming nature of the day-laborer's excessive toil, and how heavy is the burden which he is compelled to bear. But bodily suffering is not all that he has to endure; for his morality is seriously assailed by necessitated association in tenement houses with the vile, the ignorant, and the profane.

The deplorable condition of moral and physical suffering, at present experienced by a large number of

the laboring classes, can only be alleviated by philanthropy, and by a knowledge of hygienic *régime ;* and the latter is only to be obtained by a thorough insight into the physical organization of the human body. It is the object of this work to present such an insight in as plain and comprehensive a manner as the subject will admit ; and the writer trusts that an accurate understanding thereof will prove of great advantage to every grade of society.

PART II.

HUMAN ANATOMY AND PHYSIOLOGY.

CHAPTER I.

ANIMAL LIFE—THE NERVOUS SYSTEM—ASSIMILATION—NERVOUS SENSATION AND EXHAUSTION.

How animal life is sustained—Organization of the animal system in relation to the vital forces—Nerves, their distribution and various functions—Assimilation and growth dependent upon involuntary motion—Nervous sensation as manifested—Nervous energy, how exhausted, and the means of accumulation.

OUR bodies are sustained and increased in size by aliment — solid, fluid, and aëriform — elaborated into vitalized or living tissues of variously constituted organs, the sustaining substance of which consists exclusively of organized matter. Vegetables derive their nourishment from inorganic matter, and thereby become organized compounds for the nourishment of animals.

Before considering the aliment which nourishes and develops the human body, together with the qualities of such aliment, it is essential that the reader should be made acquainted with the organization of the vital forces which govern the artfully contrived form, made up of flesh and bones. The flesh, or muscle, contracts and elongates, and thus causes motion and assists to sustain the bones in position. The flesh and bones are surrounded with fat and membrane, and an outer covering of skin, hair, and nails—the whole constitut-

ing the fair form of humanity. The heart, with its numerous tubes, known as *arteries*, sends forth blood to the superficies and to all internal parts; the *veins* return it again to the heart, after it has been operated upon by various organs, each one of which is sensible only to that portion of the compound constituting the mass of blood which is suited to its own functions, separating and appropriating such portion to a certain use. The whole operates in unison, extracting the nutrient parts from the blood, and rejecting the useless, which is thrown off as *effete* matter in solid, fluid, and gaseous forms.

To put the beautiful arrangement of the nervous system into operation and to subject it to control, there is a grand centre—the brain and spinal marrow—which sends forth millions of the most delicate filaments, denominated *nerves;* and these nerves convey impressions to the great centre, which is the mysterious place where soul and body meet. Here presides the living principle which is known by its acts as the mind or will. It is said that the mind receives all the impressions conveyed by the nerves, just as objects through the medium of light make impressions upon the optic nerve—the mind receives them, and we are made conscious of the object before us. Undulations of air which are produced by concussion and communicate sound to the ear, and impressions made on the organs of taste, smell, etc., are all signified to the mind; even the prick of a pin in any part of the body, however remote, is instantaneously transmitted to the brain. Heat and cold are readily recognized, and we are made conscious of the effect. The nerves, there-

fore, are the peculiar and essential messengers of the organs of sense, through which we seek the intermediate links between mind, body, and the material world. Yet we, creatures of the mind, often form ideas which are deceptive, in consequence of our being liable to a misconception of objects as they really exist; for it is only by gradual tuition that we can attain ability to discriminate with any degree of certainty.

In the animal organization, *assimilation*, or the process of formation and growth, is carried on without consciousness, by means of internal nervous influences. And here it must be observed that the process of nutrition progresses not only in healthy parts of the body, but in those where the nerves of external sensation and voluntary motion are paralyzed, as, for instance, a paralyzed arm or leg; for in them the blood circulates and the limbs are nourished the same as if the parts were not paralyzed. Thus it will be noticed that we have a set of nerves not subject to the mind or will, but still sustaining the functions of digestion, circulation of the blood, secretion, and even, to a limited extent, the restoration of parts, as the healing of severed portions of the flesh or bone. This is denominated *involuntary motion*, and it continues as long as life exists.

Communications are made along the telegraph wire by means of electricity. The nervous cords or tendrils convey communication in a somewhat similar manner, for it is through them invisibly and instantaneously transmitted to the great centre of perception. All we know of such action is, that it exists, and is not

manifest after death; consequently, it is the vital or living force, which under certain circumstances is increased or diminished. It is expended by all the motions, and most rapidly by extraordinary exertion of body or mind. The laborer and the student, by over-arduous and incessant application, are made equally sensible of its failure; nor is the gourmand exempt from a restriction of the supply of vital force, which is in his case expended in digestion. The latter experiences his failure of vital force by a torpid condition and an inclination to sleep, induced by a concentration of nervous energy in the digestive organs. Though over-exertion leads to a desire for repose, the rest that is obtained after intemperance in eating and drinking, or after excessive mental or physical labor, is not always successful in its restorative powers; for sleep is only intended by a wise Providence to relieve those who are temperate in their demands upon the vital energy. Sleep is a necessary interim in labor, during which time there is an accumulation of vivified strength, sufficient to meet the ordinary requirements; and this strength will increase by a slow, gradual demand for it. Hence, labor, mental or physical, if gradually and regularly increased, will, after a time, produce extraordinary vigor and power, and cause the digestion to increase almost to gluttony. Under such circumstances, alcoholic drink and taking poisons to a great extent may be indulged in. It is by this ability to accumulate nervous energy that we are enabled to endure great hardships and changes of climate.

CHAPTER II.

THE SENSORIUM COMMUNE—MUSCULAR MOTION.

All sensations are received by the *Sensorium Commune,* and result in ideas—Impressions made upon the body are recognized and termed *Consciousness*—The pleasurable senses of sight and sound—Advantages obtained from all the senses—Muscular motion and its advantages—Motion of muscles controlled by the will, termed *Voluntary Motion*—Organs of sense dependent upon muscular motion—Nerves of voluntary motion distinct from nerves of sensation, and termed *Motor Nerves.*

IT is generally admitted that sensation arises from the action of natural objects on our organs; but all that we know must be reflections of the mind. Any thing we see is impressed upon the eye, and determined at the great centre, denominated the *Sensorium Commune*, from the impression made upon that organ. If we wish to do any thing, the command comes from the great centre, and muscular movement is put into operation. The sensations of touch, whether created by the fingers being placed upon an object, or by some impression made upon the body, are received upon a most sensitive organ—the skin—whence they are conveyed to the great centre. The utterances of the tongue are sounds producing undulations in the atmosphere, which act upon the organ of sound—the ear—and are conveyed to the *sensorium.* These sev-

eral sensations are termed *consciousness*, and are either pleasurable, painful, or indifferent. Being mental perceptions, they constitute ideas, followed by the emotions of thought, reflection, and action.

When we contemplate the advantages and gratification we enjoy from each of our senses, and are in possession of all of them, who can refrain from giving thanks to that Almighty power who has so wonderfully blessed us? Most of our ideas owe their origin to the sense of sight. It is to it that we are mainly indebted for our acquaintance with the records of knowledge, the thousand varieties of beautiful birds and flowers, the works of sculpture and painting, and the gay tints of art, in seemingly endless diversity, and yet excelled by nature. And it is through it that we discern every expression given by the eye, "the mirror of the soul," in which we behold intellect, the impulses of passion, of love, of hatred, and of scorn, as well as of apathy and ignorance; and lastly, the melancholy indications of misery and death. If it were not for sight, where would be our records of past time? Where our improvements in the sciences, which have enabled us to advance upon the experiences of those who have preceded us? Without the eye there would have been neither art nor artist, nor any written evidence either of human acquirement or of advancement in civilization!

Although the advantages which the sense of vision has conferred upon us are wonderful, those which we have obtained through the medium of the sense of hearing are also astonishing. It is by the ear that man holds converse with his fellow-man. Without

it we could not enjoy the delightful prattle of our offspring, nor the cheerful influence of the sweet music of the human voice, whether in song or in whispering words of hope and consolation. Without it all would be quiet.

The sense of smell, too, when considered in connection with the other senses, must be highly appreciated. It, likewise, contributes greatly to our pleasure. The appearance of the flower is not more delightful to us than the sweet odor which we inhale from it, and it is much enhanced in our estimation by this property. By the sense of smell we are also regaled with the delicious fragrance of our food, our fruits, and our volatile oils—the perfumes of the latter being remembrances of the flowers from which they were extracted.

Food, it will be admitted, is made agreeable by the sense of taste, which, though often abused, is not the less appreciative. By this sense, we are frequently enabled to detect what would be pernicious to our health, while, at the same time, it contributes largely to our social gratification, and in a manner which is not otherwise obtainable. A choice delicacy sent to a sick friend often leaves upon the mind of the invalid a lasting impression of the kindness received.

The sense of touch resides in the whole surface ot the skin, extending over the body. It is subject to pleasing and painful impressions, and is one of the safeguards of the system. Nearly all painful sensations are confined to the skin, as but slight pain is felt after the integument is removed.

Our muscular efforts are guided by the senses of sight and touch. The blind depend upon the latter,

which becomes remarkably exquisite, and consequently not only enables them to prosecute mechanical pursuits to a limited extent, but affords them amusement in their leisure hours. It also offers them the consolation of being able to read, by the means of raised letters, and thereby opens to them the privilege of perusing the blessed Scriptures.

Thus far we have been considering the functions of sensation and perception; but how much enjoyment should we be deprived of if we were mere stationary objects, having no power to move ourselves from place to place! Under such circumstances we should fail to enjoy the various changes of scenery presented in different localities, and should be denied the many advantages we derive from the movement of our limbs. Yet we not only possess this power to move, but we are endowed with the faculty of spontaneous action—*voluntary motion.* The muscles move the limbs, the trunk, the head, and the organs of sense; and these movements are dependent upon a set of nerves, distinct from those of sensation. The mental act, or will to move, is directed by the great *sensorium*, through the medium of what are called *motor nerves*, which are distributed to the muscles and produce purely physical action. They thus differ from those of sensation that produce perception, which directs our muscular movements, enabling us to travel and gratify our senses, and to labor and thereby preserve good health.

CHAPTER III.

ANATOMY OF THE BRAIN AND NERVES.

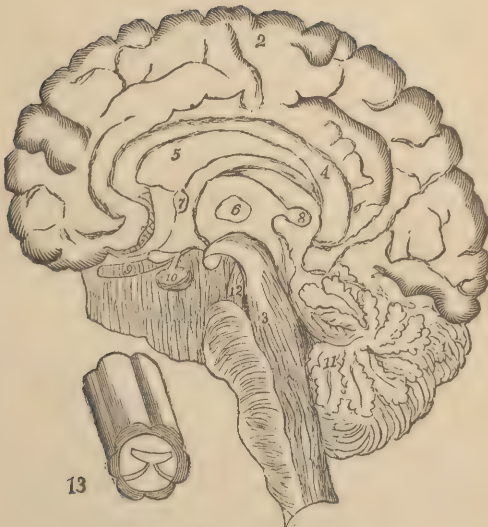
The brain and nerves described—Comparative view of the lower and higher order of animals—Description of the spinal cord, and its distribution of nerves—Intermingling of the spinal nerves with the sympathetic nerve and its ganglions—The anatomy of the brain, illustrating the several portions—The wonderful operation of the nervous system beyond our comprehension.

HAVING slightly noticed the functions of the nervous system, it may not be uninteresting to the reader that we should now give an outline of the brain, the spinal marrow, and the nerves.

The brain is usually described as a prolongation of the spinal marrow, from the fact that the lower order of animals have but a very small brain, compared with that of man; and in some animals having a spine there is scarcely any increase in size at the beginning or end of the spinal cord. In all animals having vertebræ, or spinal columns of backbones, there is an elongated cylindrical-formed mass of matter, known as the *spinal marrow*, and, as is the case in man, lodged in the canal formed by the open rings in each of the backbones. This spinal marrow or cord is composed of six parallel columns, two in front, two in the middle, and two on the back; all closely joined together, and so conjoined as to form a uni-

form cord, which is of soft substance. On each side of the spinal cord or marrow, and between the bones, there proceed two sets of nerves—one set, coming from the back or posterior columns, being appropriated to the functions of sensation, and the other, arising from the anterior, to those of voluntary motion. The nerves of sensation pass through a small ganglion, or mass of nervous matter, some short distance from the spinal cord, and there unite with the nerves of voluntary motion and form a common trunk, giving off fibres to the organs of sense, to the muscles, and to all parts where sensation and motion are manifested. Each of these spinal nerves gives off branches to the ganglions formed by the sympathetic nerves which pass down on each side of the spinal column, parallel with and near to it. They are quite peculiar in formation, having at intervals ganglions or enlargements, and give off nervous filaments to the organs *not subject to the will*—described in another page of this work as acting independent of the will, and denominated *involuntary motion*—such as respiration, digestion, circulation, restoration of parts, etc.; consequently their influence is exerted on all parts of the system, and in sympathy with the other nerves.

The brain may be considered as an expansion of the upper portion of the spinal marrow, and is divided into several lobular portions. The first is oblong, passing up in front to near the centre of the brain, and is termed the *medulla oblongata*. Another enlargement, which rises from the posterior or back column, and is styled the *cere'ellum* or lesser brain,



VERTICAL SECTION OF THE BRAIN.

1. The *cerebellum*, or lower portion of the brain.
2. The *cerebrum*, or upper portion of the brain.
3. The *medulla oblongata*, or upper portion of the spinal marrow.
4. The *corpus callosum*. A white band that connects the two hemispheres of the brain.
5. The *septum lucidum*. A soft portion of the brain that separates the two lateral ventricles.
6. The *middle commissure*.
7. The *anterior commissure*.
8. The *posterior commissure*, uniting portions of the brain.
9. The *optic nerve*, passing out to the eye.
10. The *pituitary gland*, located in the centre of the base of the brain. Its functions are unknown.
11. The *arbor vitæ*, or "tree of life." The appearance of the *cerebellum* when divided longitudinally.
12. The *pons varolii*. That portion of the *medulla oblongata* that unites the upper and lower portion of the brain.
13. A transverse section of a portion of the spinal marrow.

forms the lower back part of the brain. Next follow two small lobes, known as the *optic tubercles*, which appear to spring from the middle portions; and then come the large hemispheres, called the *cerebral hemispheres*, which constitute the upper portions, and are formed from the front or anterior columns of the spinal marrow. In these front lobes are found a pair of tubercles, called the *olfactory lobes*, and connected with the nerves of smelling. There are in addition to the parts here described several others which are only of interest to the anatomist.

The moving principle of all this wonderful arrangement of the nervous system is completely hidden from man, who can only examine the structure and behold with admiration the effect produced from surrounding influences. When it is stated that the contraction of the heart causes the circulation of the blood, inquiry naturally is made, what gives rise to the contraction? The reply is, the advent of the fluid; and thus we reason in a circle. The impulse of the will causes muscles to act, of which we may not know the existence or the name; yet, quicker than thought, the desired motion is accomplished. In the performance of an expert pianist, who touches the keys with his fingers, and produces definite sounds in exact accordance with the notes systematically arranged to produce them, we have an inexplicable operation of the will and response of the muscles. This is evinced in the creation of harmonious strains with a rapidity of motion that exceeds thought, the fingers and other organs responding to the impulse of the will. Examples of the kind are of such frequent occurrence that we do not attribute to

them any thing remarkable; but, upon reflection, we are filled with astonishment and admiration, and are compelled to admit that the elucidation of the matter is far beyond the comprehension of our limited reason.

CHAPTER IV.

VITALITY; OR, THE LIVING PRINCIPLE—TEMPERAMENTS.

Vitality, or the living principle incomprehensible—Whence energy to support muscular motion is obtained—Comparative influence of electricity in supplying nervous energy—Temperaments, and their influence upon individual character—Circumstances alone govern the temperaments of individuals for good or evil.

THE study of the vital force or living principle has been an unprofitable one, and must remain so as long as men persist in their attempts to pass beyond the boundaries of reason and experience. Knowledge of the subject, sufficient for the business of life, is already ascertained, and any further inquiry into it can only prove a source of useless and perhaps injurious distraction of the mind.

All the organs, and their relations with the nerves, from whence they derive their energy, which we have just described, are supported by the organs of nutrition. To the latter we shall allude in subsequent pages; but we wish here to impress upon the mind of the reader the fact that it is upon the integrity of the brain, nerves, and spinal marrow, that all the functions, even life itself, depend; for, if the communica-

tion be interrupted, or the nerves cease to act, partial if not total loss of power ensues. As to what energy consists of, we must repeat, we do not know. It is very similar to electricity, but, like gravity, it is a name for certain ultimate phenomena; and this is because some nerves regulate muscular motion, and others are a medium of sensation in general, while there are yet many more that serve specific purposes. Involuntary action is produced, the continuance whereof being essential to life, it could not be wholly left to our uncertain attention. The manner in which the nerves act, and the functions of many of them, are unknown; but, as their functions vary, nervous energy is unlike that of electricity, which, though Sir WILSON PHILIP has made it digest the food in a rabbit's stomach, after the destruction of the nerve which gives energy to that organ, can not, however, be made to perform many other functions than those of a curative nature—such as its employment as a means of renewing dormant powers; and for this, if judiciously used, it is a very potent agent, differing as much in its curative tendencies as in the sources from whence it is produced. It was galvanic electricity that promoted digestion in the rabbit's stomach; but galvanic electricity has not proved very successful in restoring nervous energy to the powers of locomotion. Electricity produced by friction on glass, on the other hand, has succeeded far better in reinstating muscular energy in the limbs—as in cases of paralytic affection; but even electricity of this nature, by its continuance in force, does not enable a man to

walk. Consequently, it is not a substitute for nervous energy.

An exuberance of mental nervous energy inducing extraordinary action demands attention, from the fact that it is often made an excuse for actual excesses, and is generally believed to be uncontrollable, being regarded as the temperament of the individual. Temperament, it is true, has much to do with the development and activity of the physical powers, but it has little to do with the direction of the mental; it must, therefore, be considered an indulgence of an encouraged propensity, and not an uncontrollable disposition. If properly controlled and directed, it may be made of great advantage to the individual blessed with an extraordinary quantum of nervous energy, whether used mentally or physically. Hence the ability of some to accomplish greater achievements than others, and, thereby, become enabled to benefit their less-favored fellow-men, who are not gifted with superior mental or physical force. Circumstances alone govern temperament. If a person is carefully educated, or if his course of life is properly directed, with due regard to the leading traits of character, the temperament can be restrained, or encouraged and improved, by judicious training, either mental or physical. Whether phlegmatic, sanguine, or bilious in temperament, we have varieties of constitution. Some persons are cold and indifferent, but with proper training they can be made mindful of their fellow-creatures, and, as they are constant and staid in their habits, contributors to their happiness. Others are lively and ever ready to enjoy themselves even at the expense of injuring the

feelings of their most intimate friends. Such are of a sanguine temperament, are frivolous in disposition and acute in perception, but, under proper guidance, in whatever pursuit they are engaged in, their tendency is to improve and to complete with refinement and elegance. Their disposition is frank, courageous, animated, mild, and cheerful; their memory is happy, and their imagination lively and brilliant. Furthermore, they are inclined to pleasure, and prefer taste rather than the indulgence of their passions. The bilious temperament is not so easily defined. Persons thus constituted usually have a fine imagination, and a solid and deliberate judgment. They are often conceited, obstinate, and misanthropic; have more genius than wit, are ardent in pursuit, and are well calculated for the investigation of abstract sciences.

Individuals possess these temperaments in a greater or less degree; consequently, no correct opinion can be formed of any person who is presumed to be imbued with one or other of them, as the constitutions of people differ so much, that there exist as many varieties as there are individuals. It is only where one or other of the temperaments predominates, that the traits of character we have described can apply with any degree of plausibility; and even these, as we have just stated, are subject to modification by education and other surrounding influences. Our physical energies are subordinate to our moral and mental impulses. The influence of man on man, in modifying his organization and tendencies, is only inferior to that of nature herself.

CHAPTER V.

COMPLETENESS OF THE HUMAN FORM—ORGANS OF NUTRITION.

Admirable arrangement of the human form—The importance of the hand almost equals speech—The various organs of nutrition and their functions—The living animal form in constant motion, thus expending sustenance, termed *Nutrition*—Animalized material—The process termed *Assimilation* accomplished through the organs of *Circulation* and *Respiration*.

THE admirable arrangements of the human form merit special attention. The framework is of great strength and lightness, having hollow cylinders for shafts, while the contour is formed from masses of muscular flesh which perform acts of endless utility, the whole possessing great power, and presenting an appearance of grace, beauty, and dignity. The stature is erect; the limbs are supple and formed for progression; the joints are well knit; the feet, plumb beneath the frame, form an ample base; and the fingers are fitted for innumerable diversified appliances. The hand, in fact, almost equals in importance the organs of speech. It certainly does not reason, but still it is the willing attendant upon our thoughts, and with the pen and with type perpetuates the products of the intellect, and presents to the human race the wisdom and genius of superior minds.

The mouth is conveniently placed for the reception of food, and the well arranged teeth, which contribute much to the beauty of the person, for the mastication of it. The brain, spinal marrow, heart, and lungs—the most vital organs—are protected by bone; and beneath the bone, and extending over the stomach, liver, alimentary canal, and other internal organs, is a delicate vesture, called the *peritoneum*, which covers the whole, and protects the organs while in the performance of their functions, namely, receiving impressions, elaborating nutriment, and rejecting waste and superfluity. The lungs are so admirably constructed, that the slightest effort fills their cells with air; the eyes and ears are so situated as to be enabled to receive impressions most readily, without being incommoded; and the limbs are so adjusted and placed as to give them the greatest possible latitude of movement. In a word, every portion of the human frame has been arranged in the manner best fitted to adapt all parts to the exigencies of our position.

The human form, like all other animal forms, is, while under the influence of life or the vital forces, in continual voluntary or involuntary motion. This motion can not be maintained without some sustaining medium that will suffice for the proper action of the organism for the renovation of parts, for which purpose new materials are wanted and must be regularly supplied. Hence there exists a class of functions which perform a great number of operations essential to the maintenance of vitality, and are comprehended under the title of *nutrition*. Organized food is not only indispensable, but it must possess the chemical

properties of the animal substances with which it is to be afterward incorporated; and by being acted upon by certain organs, it undergoes a suitable change. This action is known as *assimilation*, of which *digestion* forms the principal part. The next operation in the system is the distribution of this animalized nutriment, which is formed into blood and disseminated wherever it is wanted. The necessary motions for this purpose are given to the blood by the organs of *circulation*. The principal of these is the *heart*, which great vital organ impels the blood through the *arteries* and receives it back again by the *veins*. The next process is the purification of the blood by the chemical action of oxygen upon the accumulated carbon. This is accomplished by *respiration*. Another stage of nutrition appertains to the more immediate application of the purified material to the wants of the system—to the growth of the organs, to the reparation of their losses, and to the restoration of their exhausted powers.

We may regard life as a continued series of actions and reactions, ever varying, yet constantly tending to definite ends. Most of the parts of which the body consists undergo continual and progressive changes in their dimensions; the materials that have been united together and fashioned into the several organs, are removed and replaced by fresh materials, which, in their turn, are supplanted by new ones, though without any perceptible change of external form. In fact, all parts of our bodies are constantly undergoing transformation, and contributing to our necessities by the very means from which we obtain warmth and strength.

CHAPTER VI.

MUSCULAR MOTION AND THE CIRCULATION OF THE BLOOD.

Man's inability to approach in completeness nature's works—Contractility constitutes all muscular motion—The heart a powerful muscular motion, sustaining the circulation of the blood—The anatomy of the heart fully described.

IT is only by life or the living principle that organic forms are produced. Human power can never approach in completeness the most simple of nature's works. The living body differs from inorganic machinery, as it contains within itself a principle of motion not referrible, as far as we can perceive, to any primary forces which exist in the inanimate world. This principle, which has been termed *contractility*, produces the action of muscles, and enables the heart and arteries to propel the blood to the superficies and all parts of the animal structure.

The *heart*, a powerful muscular organ, receives a constant stream of blood, which gradually dilates an apartment, denominated the *auricle*, the muscular fibres of which do not contract until they are stretched beyond a certain point, when, with a sudden impulse, the blood is thrown into another apartment called the *ventricle*. The ventricle, being rapidly distended, is excited to a quick and forcible contraction, and pro-

pels the blood into the artery with an impulse incomparably greater than could have resulted from the action of the auricle alone; and, to prevent a retrograde motion, very perfect valves are interposed between the auricle and the ventricle.

The auricle receives blood from two sources, the upper and lower *venæ cavæ*. The valves are composed of two loose membranes, the outer edges of which are attached circularly to the aperture of communication between the cavities, and the inner edges project into the ventricle. By this means they perform, as it were, the office of floodgates, as they allow a free passage to the blood, when it is impelled into the ventricles, and are pushed back the moment the ventricle contracts; in which latter case they concur in accurately closing the aperture, and preventing the return of blood into the auricle. These valves being attached to a wide circular aperture, are consequently restrained from inserting themselves into the auricle. Each ventricle is provided with slender muscular cords, fixed by one end to the edge of the valve, and by the other to a part of the inner surface of the ventricle. By this arrangement the valve is always kept within the cavity of the ventricle, while the blood is propelled through the great artery termed the *aorta*. In the auricles, the same purpose is answered by the oblique direction in which the veins enter it. The arteries, when distended, also contract, and in the aorta there are valves. These valves consist of three membranes, which have the form of a crescent, and are capable of closing the passage so closely that a drop of blood can not pass between them.

From the aorta, large arteries are given off, and from these arteries numerous branches divide and subdivide, till the ramifications arrive at an extreme degree of minuteness, and are finally distributed to every organ and to the remotest parts of the system. And that parts may be provided for, in case of obstructions, they frequently communicate with one another, and are said to *anastomose.* The smallest of them, which are finer than hairs, are termed *capillary vessels;* these frequently form distiguring blotches upon the face, and particularly upon the faces of infants. After the blood, with the required nourishment, has been conveyed to all parts of the body, it is carried back to the heart, as we have previously stated, by the *veins.* The latter commence at the extreme ramifications of the arteries, and, in their progress to the heart, the smaller branches join in succession to form larger trunks till they finally unite in the vena cava.

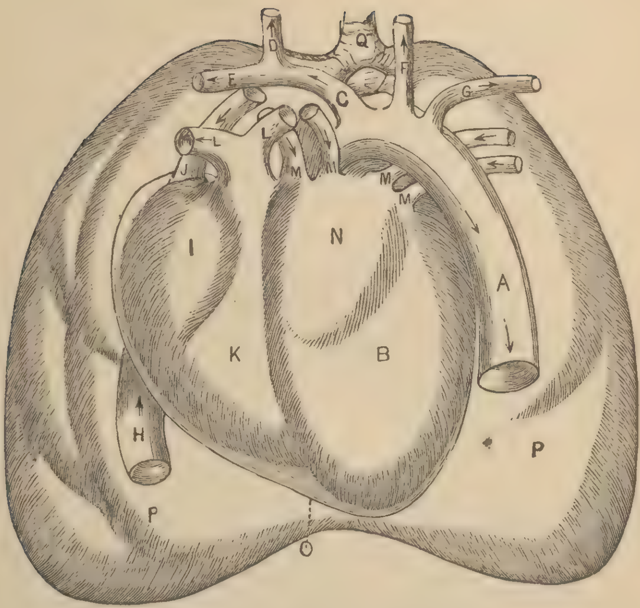
Of the veins, the larger are more numerous than the arteries, and many of them are supplied with valves, thus differing from the arteries, as in the latter there are valves only in the aorta. These valves are more especially provided in the veins that pass over the muscles of the extremities, or which run immediately beneath the skin, and all open in the direction of the heart; consequently, as long as the blood flows in its natural course, it meets with no impediment, whilst a retrograde motion is effectually prevented.

The communication of the capillaries with the veins is readily discovered under the microscope, especially in frogs and fishes, whose membranes are very trans-

parent. Lewenhoek, on examining the circulation in tadpoles, expressed himself in the following terms: "The pleasure has oftentimes been so recreating to me, that I do not believe that all the pleasure of fountains or water-works, either natural or made by art, could have pleased my sight so well as the view of these creatures has given me." *Phil. Trans.* xxii. 453.

The color of the blood, when conveyed by the arteries, is bright scarlet, and, when returned by the veins, dark purple—the change being caused by the quantity of carbon that has been thrown into the stream. After the blood has reëntered the heart, it requires to be purified and again fitted for arterial circulation, an operation which is performed by the lungs and by a distinct set of arteries and veins. The vessels we have already described are subservient to nutrition, and are termed the greater *systemic* circulation. Those, however, which circulate the blood through the lungs for the purpose of purification by air, compose the system of the lesser or *respiratory* circulation.

The blood passes alternately through the greater and lesser circulations—a complete apparatus being provided for each. The two compartments on the left side impel the blood through the greater systemic circulation, while those on the right side are appropriated to the lesser, or respiratory circulation. Thus the blood, in its passage through the human system, takes the following course: From the left ventricle it is propelled into the aorta, and thence diffused through the arteries to every part of the system, finally penetrating into all the capillary vessels. From the latter



THE HEART AND BLOOD-VESSELS.

GREATER CIRCULATORY SYSTEM,

by which the blood is distributed to all parts of the body.

A, the *aorta*, or great artery, whence is distributed the blood which is impelled into it from B, the left *ventricle*.

Branches of the Arteries.—C, *arteria innominata*. D, right *carotid*. E, right *subclavian*. F, left *carotid*. G, left *subclavian*.

The Veins.—H, ascending *vena cava*, which returns the blood from all parts of the body and limbs to I, the right *auricle*. J, the descending *vena cava*, which conveys the blood from the head to the right *auricle*, whence it is forced into K, the right *ventricle*.

LESSER CIRCULATORY SYSTEM.

K, the right *ventricle*, which forces the blood through the pulmonary artery. L L, branches of the *pulmonary artery*, by which the blood is conducted to the lungs to be changed into arterial blood. M M M M, four *pulmonary veins*, by which the arterialized blood is conveyed to N, the left *auricle*, to be forced into B, the left *ventricle*, and thence to A, the *aorta*.

O, an outline of the *pericardium*, which incloses the heart.

P P, the *lungs*, drawn small comparatively to the size of the heart.

Q, the *trachea*, or windpipe, and its branch to each lung.

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it flows, in its return to the heart, through the veins and the *venæ cavæ* to the right auricle, which delivers it into the right ventricle. This right ventricle then impels the blood, thus received, into the pulmonary arteries of the lungs, whence it is distributed and acted upon by the oxygen of the air inhaled; and it is next conveyed by the pulmonary veins into the left auricle, which throws it into the left ventricle, the point where it commenced its course. The right and left cavities are kept perfectly distinct from one another, and are separated by thick partitions—the whole being inclosed in one envelope termed the *pericardium.* The two auricles and the two ventricles act in the following manner: At the moment when the left ventricle is propelling its aerated blood into the aorta for the purpose of general nutrition, the right ventricle is driving the vitiated blood into the pulmonary artery of the lungs, in order that it may be purified by the influence of the air. Consequently, the same blood, which, during the interval of one pulsation, was passing through the lungs, is, in the next, circulating through the body; and thus, the contractions of the auricles and ventricles impelling the blood through the arteries to be returned by the veins, all concur in the same general end.

CHAPTER VII.

PROCESSES OF DIGESTION AND NUTRITION.

Nutrition, as supplied to the system through the *Lacteals*, termi nates in the *Thoracic Duct*—*Chyle* the product of digestion—Change in the mass of food eaten first takes place in the stomach—*Gastric fluid* reduces all natural fluid to a pulp, which is acted upon by a peculiar motion of the stomach—*Chyme* is formed in the stomach and *Chyle* in the intestines.

THE blood being the medium through which nutriment is distributed to the several parts of the body, there is a constant diminution in the quantity of that fluid which must be supplied; therefore, for the purpose of such supply, we have another set of circulating vessels, called *lacteals*, which terminate in the *thoracic duct*, and this thoracic duct conveys what is called *chyle* into one of the large veins near the left auricle of the heart. Chyle is elaborated by the vital or living forces of the digestive organs; and for its nutritious qualities is dependent upon the healthy condition of those organs and on the quality of the food taken.

Digestion requires first the mechanical operation of the mouth. The food is masticated by the jaws and teeth, and is, at the same time, intermixed with the fluid secretions of the mouth, from whence it passes through the muscular tube or throat, called

œsophagus, into the stomach, the entrance of which is termed the *cardia* or cardiac orifice of the stomach.

In the stomach the food undergoes various changes; and it is in it that the first digesting process takes place. What is called *chyme* is here formed, and here the nutritious matter is prepared to pass through the *pylorus*, or pyloric orifice of the stomach, into the intestines. In the intestines it is further subjected to the action of several fluid secretions derived from the *liver* and *pancreas*. These secretions, acting upon the mass, produce from it chyle, ready to be absorbed by the lacteals. With open mouths, the lacteals arise from the inner surface of the intestines and pass along a membrane termed the *mesentery*, which connects the intestines to the back. These lacteals form trunks which increase in size until they terminate in a reservoir, or receptacle of the chyle. From this reservoir proceeds the *thoracic duct*, which passes along the side of the spine upward to the vein, and enters the left auricle, where it deposits the chyle into the blood, which latter passes into the ventricle to be thrown out to all parts of the system. It is thus that nourishment is distributed. Each organ selects its own peculiar nutriment, when new products are formed and new properties acquired, adapted to the respective purposes which they are to serve in the animal economy. The whole is subservient to the higher purposes of vitality, and these powers themselves minister to the more exalted faculties of sensation and intellect.

It would appear to be in the stomach that the first change takes place in the mass of food eaten. This organ is exceedingly simple in form in the human

family, being merely a receptacle. The *duodenum* is the first part of the intestinal canal, commencing at the pyloric orifice or exit of the stomach, and terminating in the *jejunum*. Its length is about twelve fingers' breadth, and, as it is only partially covered by the *peritoneum*, it is susceptible of considerable dilatation. The pyloric passage is constricted by a fold of the inner membrane, which latter is surrounded by a circular band of muscular fibres. This band performs the office of a valve or sphincter, and completely closes the orifice of the stomach during the digestion of its contents.

The principal agent in digestion, as far as chemical means are concerned in that operation, and as influenced by the vital force, is a fluid secreted by the coats of the stomach, and termed *gastric juice*. This fluid reduces all natural food to a pulp, and is said to possess different qualities in different animals, acting only upon the food peculiar to the animal.

Sir Everard Home has devoted much attention to the structure and action of the stomach, and it has been discovered that a peculiar motion is produced, which completely intermixes the gastric juice with the mass of food. When different portions act in succession, they propel the food from one part to another, and thus promote the mixture. The food remains for some time in the stomach, in order to be perfectly digested, for the accomplishment of which purpose the closing of the pyloric orifice would seem to be intended. The gastric juice possesses a peculiar property of coagulating fluid albumen, such as the white of eggs, or milk; but it is not like to an acid, as albu-

minous substances are not rendered sour or acid when a natural condition exists. It is supposed that this change from fluid to solid is for the purpose of detaining the food for some time in the stomach—all fluids, if not in excess, readily passing off—and thus preparing it to be thoroughly acted upon by the digestive powers of the stomach. We may hence infer that much fluid interrupts the process of digestion; but of this we will treat in another chapter. Another remarkable property of the gastric juice is, that it corrects and arrests putrefaction. This is exemplified in animals which feed on carrion, as they are enabled to derive wholesome food from materials which would otherwise taint the whole system with poison and be destructive to them. Thus it will be observed that the gastric juice is a peculiar animal secretion essential to digestion.

The food, having passed through the pyloric orifice, is now subjected to a further process of digestion, and the formation of *chyle* commences in the intestines. This chyle is formed out of the chyme produced by the stomach. Provision is made in the interior of the intestinal canal for subjecting its contents, *first*, to the action of an extensive vascular and nervous surface or great diffusion of small blood-vessels; and *secondly*, to various secretions derived from the liver and other sources which exercise powerful chemical changes on the digested aliment. When the system is in a healthy condition, a vigorous muscular action is exerted, termed the *peristaltic motion*; while interruptions, caused by irregularities in a portion of the intestinal canal, tend to retard the progress of the

aliment in its passage through, so that it may receive the full action of these several agents and yield the utmost quantity of nutriment. As we have already stated, the chyle is taken up by the lacteals, to be conveyed by the thoracic duct to one of the large veins near the heart. This is the course which every particle of nutriment has to take to nourish the system.

The chemical composition of chyle appears to be very analogous to that of blood, into which it is converted, and by it is carried to all parts of the system, to be deposited in the various organs, where it replaces the particles no longer of use, which latter are conveyed by the veins and finally thrown off as effete matter.

CHAPTER VIII.

THE DEPURATION OF THE BLOOD AND EVOLUTION OF HEAT.

Blood is purified in the skin and lungs, and heat is thereby developed—Structure of the lungs described—Their functions.

A SECOND essential object of the circulation of the blood is the transmission of the nutritive matter to certain organs, where it is subjected to the influence of the oxygen of the atmosphere: a process which, in all warm-blooded animals, combined with the rapid and extensive distribution of the blood, diffuses and maintains throughout the body the

high temperature required by the greater energy of the system. Hence, a vigorous influence is exerted in the *lungs* upon the blood, for the purpose of eliminating from it heat, the result of powerful chemical action. And the energy of every function is regulated in a great measure by the quantity of blood received by the organs so operating. The muscles of the leg or arm, if extraordinarily exercised, are not only of a deeper color, but they maintain a greater amount of warmth, and are much stronger than limbs not so exercised.

The *lungs* consist of an assemblage of vesicles into which the air is admitted by a tube, called the *trachea* or windpipe, which extends downward from the back of the mouth, and parallel with, but in front of the *œsophagus* or throat. The entrance to the windpipe is carefully provided with a cartilaginous valve, termed the *epiglottis*, which is made to close by the action of the muscles that perform *deglutition* or swallowing, just previous to the passage of what is to be swallowed. Thus, great care is taken to guard this passage against the entrance into it of any solid or liquid food. At the upper part of the chest, the trachea divides into two tubes called the *bronchia*, which pass to the lungs on either side. Both the windpipe and the bronchia are kept open by firm cartilaginous rings which are interposed between their inner and outer coats, and are placed at short and equal distances from one another. The natural elasticity of these rings also tends to control the calibre of the tubes when breathing, in addition to causing them to remain open. The bronchia then divide

and subdivide in regular order, and branch like a tree through all the substance of the lungs, until their tender extremities terminate in the air cells. The cartilages of the bronchia, situated near the trachea, resemble the trunk of a tree, but the rest, like small branches, become weaker, more oblique and irregular, and further removed from each other, until the extremities are little more than membraneous tubes.

The *bronchial cells*, into which the air is admitted in respiration or breathing, are spiral, and are attached to terminal branches of the bronchia. They have no communication with each other, but are held together by a minute cellular texture. HALES estimated that these cells were one hundredth part of an inch in diameter, and that their extended surface was ten hundred and thirty-five square inches. It is pretty generally admitted that, on an average, forty cubic inches of air are alternately taken in and expelled at each ordinary act of breathing; and it is supposed that about one hundred and seventy cubic inches more may be forcibly expelled after a common expiration, such as coughing, straining, etc. After that the lungs would contain within them one hundred and twenty cubic inches. Upon this estimate there remain in the lungs, after an usual expiration, two hundred and ninety cubic inches of air; and upon inspiration there are three hundred and thirty in them, which is the measure of their capacity in a distended state. Since forty is nearly the one eighth of three hundred and thirty, it follows that it is only about one eighth of the whole air in the lungs which undergoes a change during each successive act of

breathing. Still, we possess the power of expelling, by a forcible expiration, fully two thirds of the entire quantity.

It is on these bronchial cells that the ultimate branches of the pulmonary arteries and veins are distributed, and inosculate or enter each other. The thin membrane of the cells and the coats of these minute vessels do not prevent the influence of the air upon the circulating blood; and it is here that the great chemical change in the blood takes place—a fact which should remind us that the lungs are extremely delicate organs, and how necessary it is that they should be naturally protected.

The cavity, or chest, in which the lungs, together with the heart and its great blood vessels, are inclosed, is termed the *thorax*, and is somewhat conical in form. The contents of the thorax are defended from compression by the ribs, which extend from the spine to the *sternum* or breast-bone and produce mechanical support, and are so arranged that they can enlarge or diminish the cavity and promote breathing. The base of the cone is inclosed by what is called the *diaphragm*, which divides the chest from the abdomen, and forms a complete partition. Being a muscle, the diaphragm can be extended or contracted. It is perforated, close to its origin from the spine or backbone, by four tubes, namely, the *œsophagus*, the *aorta*, the *vena cava*, and the *thoracic duct*. The diaphragm is convex, inward to the thorax or chest; and the direction of its muscular fibres is such that, when those fibres contract they bring down the middle part, which is tendinous, and render it more flat; and

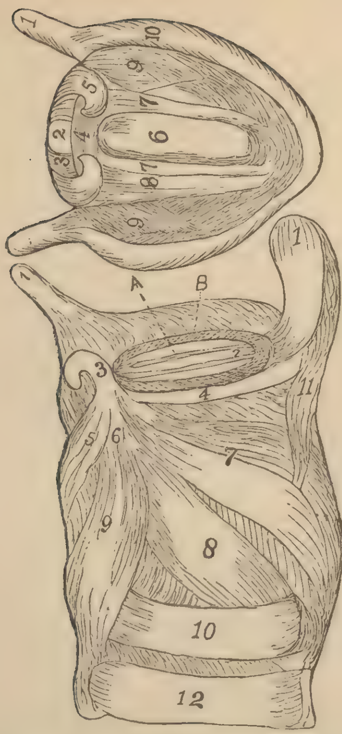
then, when the ribs are raised, the cavity of the *thorax* is considerably enlarged. The air in the lungs, by its elasticity, expands the cells and draws in more air till the lungs are filled; this is termed *inspiration.* The air is again thrown out by a reverse action, when the diaphragm tends upward and the ribs are lowered; this is termed *expiration.* Hence the necessity of freedom from restraint, in order that a natural process of breathing may be maintained and the blood thereby fully acted upon, an operation which is of essential benefit to the general health.

CHAPTER IX.

ANATOMY OF THE VOCAL ORGANS.

The vocal organs described—The Human Voice capable of every possible sound—How sound is produced.

THE upper portion of the windpipe is formed by four cartilaginous rings, termed respectively *thyroid, cricoid*, and two *arytenoid.* These rings have a number of small muscles attached to them, and are lined by a mucous membrane, the latter having certain membraneous reflections which constitute the superior ligaments of the *glottis*, or opening of the windpipe. This opening is covered by the *epiglottis* already described. The several parts here mentioned constitute the organs of speech, or vocal apparatus, termed the *larynx.* Professor CHARLES BELL,



LARYNX, OR ORGAN OF THE VOICE.

1 1. The superior *cornu*. 2. The *cricoid cartilage*. 3. The posterior *crico arytenoid ligament*. 4. The *arytenoidus muscle*. 5. The *arytenoid cartilage*. 6. The *rima glottidis*, or opening to the windpipe. 7. The *chorda vocalis*. 8. The *thyro-arytenoid muscle*. 9. The *crico-arytenoid muscle*. 10. The border of the *thyroid cartilage*.

SIDE VIEW OF THE LARYNX.

A. The *vocal chords*. B. The *arytenoid fold*. 1. The *epiglottis*. 2. *Opening of the glottis*. 3. The *arytenoid cartilage*. 4. The *arytenoid epiglottidean border*. 5. The *arytenoidean muscle*. 6. The *arytenoidean cartilage*. 7. The *thyro-arytenoid muscle*. 8. The *crico-arytenoideus muscle*. 9. The *crico-arytenoideus posticus*. 10. *Cricoid cartilage*. 11. The *thyro-epiglottidean muscle*. This muscle draws down the epiglottis to close the entrance to the windpipe. 12. A cartilaginous ring of the *trachea*, or windpipe..

who has given this subject much consideration, says: "The voice commences in the larynx, but reverberates downward into the trachea and even into the chest, whilst it may be directed with different effect into the cavities of the head, mouth, and throat."

The organ of the voice is, strictly speaking, neither a stringed instrument, nor a drum, nor a pipe, nor a horn; but it is all of these together. We shall not be surprised at this complication if we will only take the trouble to consider that the human voice is capable of every possible sound—that it can imitate every beast and every bird—that it is more perfect than any musical instrument yet invented—and that, in addition to the intonation of every variety of musical note, it is capable of giving utterance to all the combinations in articulate language which are heard in the different nations of the earth. The essential and primary part of the organ is the *thyreo-arytenoid* ligaments, termed *cordæ vocales*. The membrane which lines the larynx is reflected over these ligaments, so as to be drawn by them in their motions; and this action is referred to when it is remarked that the organ is like a drum, for this membrane must vibrate in the air. The muscles of the arytenoid cartilages draw tight the cordæ vocales and their attached membranes, and thereby give them a certain tension. The air being at the same time expelled forcibly from the chest, a vibration of these ligaments and membranes is the result; and sound is produced by the vibration being communicated to the stream of air. This sound, as it is above stated, may reverberate along all the passages from the lungs to the

nostrils; but, unless there be a certain vibration in the cords of the larynx, there is no vocalization of the breath. For example, a man in whispering articulates the sounds of the mere breath, without that breath being vocalized and made audible by the vibrations of the larynx. In singing, the vocalized breath is given out uninterruptedly through the passages—the rising notes in the gamut being produced, first, by the narrowing of the glottis, and, secondly, by the rising of the larynx upward. These various movements with the muscles, tongue, and lips—modulating the vocalized breath, and modified by reason—express alike conventional language and harmonious strains.

CHAPTER X.

CHEMICAL CHANGES IN RESPIRATION—VITAL FUNCTIONS.

Chemical changes that take place in the air we breathe—Vital Force an independent power in the animal system.

THE air we breathe—atmospheric air—consists of twenty-one per cent of oxygen and seventy-nine of nitrogen, with a mere trace of carbonic acid gas. When it has acted upon the lungs which contain the blood that needs to be purified, and is returned, it is then found that a portion of the oxygen has disappeared, and the place has been nearly, if not wholly, supplied by an addition of carbonic acid gas, together with a quantity of watery vapor, and that a

small portion of the nitrogen gas has also been consumed. The action of the air produces a most obvious effect upon the blood, as it changes its color from a dark purple to that of a bright vermilion. It is transformed from venous to arterial blood, a change which accounts for the alteration that takes place in the component parts of the air inhaled. This process of aeration of the blood has much to do with the preparation of sustenance and heat for the animal body; and thus it has been established by our most eminent chemists that oxygen is essential to animal life. It is a supporter of combustion. The food we eat, and the fuel we burn, are materials composed of the same elements; and when oxygen unites with those substances, it eliminates heat. In like manner, when it unites with the carbon in the lungs, it forms carbonic acid which is thrown off in the breath.

Oxygen is a colorless gas, inodorous and tasteless, and is in combination with nearly all of the *sixty-four* known elemental substances, which give it out and receive it under certain circumstances; hence, its combination, and disposition to combine with the food we eat and the fuel we burn. It is also the most abundant element that we know of, constituting eight ninths of water, twenty-one per cent of atmospheric air, forty-eight per cent of granite and limestone, forty-seven of gneiss and sandstone, forty-six of slate, and forty-three of basalt—these being the most abundant materials that make up the crust of the earth.

Carbon is found in a solid state, in which it is known as diamond, and we find it nearly pure in the form of charcoal. It is united with all organic sub-

stances, and is produced from them by decomposition in the form of carbonic acid gas, and, as previously stated, in the organized substances which form the food of animals; and we repeat this important fact, in order that the reader may the more readily comprehend the source from whence we obtain the heat that is eliminated in our bodies, and the chemical relation of combustion and respiration, which are the same in effect. The materials in both cases are burnt up, and the result is carbonic acid, water, and heat, which are produced in the lungs and body by slow, silent combustion.

Vital force is an independent power in the living animal body; and it is under this influence that all parts of the body are produced from a peculiar fluid, which circulates in its organism by virtue of an influence that resides in every part of an organ. All parts of the system are made to grow, and are sustained by the circulation of the blood and the aliment it contains. It is shown by experienced physiologists that, at each moment of life in the animal organism, a change of matter, more or less accelerated, is going on. A part of the structure is transformed into ordinary matter, and loses its condition of life; it is removed, and must be replaced with vitalized organic matter. Every motion and every manifestation of force is the result of a transformation of the structure, or of its substance. Every conception, every mental affection, is followed by changes in the chemical nature of the secreted fluids. Even every thought and every sensation is accompanied by a change in the composition of the brain.

PART III.

Nutrition—Climate—Sanitary Aids.

CHAPTER I.

THE NECESSITY OF NUTRITION—THE INFLUENCE OF THE ATMOSPHERE.

Nutrition essential to the sustenance of animal life—Its dependence on chemical changes—Different conditions of the atmosphere in relation to the requirements of the animal system—Animal temperature and its maintenance under varied circumstances.

TO sustain animal life, we must supply matter suited for the sustenance of the various organs. The first condition of life is *assimilation* of what is known as nourishment; and the second is a continual absorption of oxygen from the atmosphere to accomplish that necessity; so that at every moment of our lives we are taking in oxygen by means of the organs of respiration, and giving it out again in the form of carbonic acid and hydrogen. Thus certain parts of the body enter into combination with oxygen, which is introduced through the lungs and skin, and given out in the form just stated. That most exact and learned chemist, JUSTUS LIEBIG, who has been relied upon for most of the statements in relation to animal chemistry which have been made in this work, states that, by accurate determination, it appears that an adult, taking moderate exercise, consumes thirteen and nine tenths ounces daily of the quantity of carbon

taken into the system in food, and that a portion passes off in the form of excrement—in which form carbon is not combined with oxygen. This amount of carbon escapes through the skin and lungs as carbonic acid gas, and requires thirty-seven ounces of oxygen for its conversion into that gas. As no part of the oxygen taken into the system is given off in any other form —and as the carbon and hydrogen expended are, in a normal condition of health, replaced by carbon and hydrogen supplied in the food—it is clear that the amount of nourishment required by the animal body for its support must be in direct ratio to the quantity of oxygen taken into the system. Hence, quick breathing most rapidly consumes carbon, or, in other words, nutriment containing carbon, as is instanced in hard labor, or in a child, whose organs of respiration are naturally in a state of great activity. A child, therefore, requires food oftener, and in greater proportion, according to its size, than an adult; and this extra supply is necessary in order to maintain good health, for a child bears hunger less easily than an adult. This is an important fact, and should be remembered. Again, an excess of food is incompatible with a deficiency of active breathing, or of effort to produce it by proper exercise. Therefore, persons who take but moderate exercise should limit the quantity of food to their condition or situation.

Another fact to be impressed upon the mind is, that there are different conditions of the atmosphere which are affected by temperature and density. Atmospheric air is expanded by heat and contracted by cold, but equal volumes of cold and hot air contain

unequal weights of oxygen. A given quantity of atmospheric air contains more oxygen in winter than in summer; so, at the poles, the air contains more oxygen than at the equator; yet at both we inspire an equal quantity of air. Cold air becomes warmer during respiration in the air passages and pulmonary cells, where it acquires the temperature of the body; and it requires a greater amount of carbon or nourishment to make up the amount of heat expended in warming it. Hence, a person at rest in a cold climate requires an increase of food to sustain the activity that is going on in the system, and such food as contains the greatest amount of carbon.

Fruits, upon which the inhabitants of warm climates mostly live, contain about twelve per cent of carbon, whilst the bacon and train-oil eaten by the inhabitants of the frigid zones contain from sixty to eighty per cent of carbon, which amount is essential to their existence. A person would die from hunger in a much shorter time in a cold climate than in a warm one. Fruit would not sustain life in a northern latitude, because a sufficient quantity of it could not be taken into the human stomach to supply the demand for carbon. From this we may learn that all animal creation is dependent upon oxygen for existence, and that, if the proper food can be obtained, we possess within ourselves a source of heat independent of surrounding circumstances.

In whatever way carbon may combine with oxygen, the act of combination can not take place without the disengagement of heat. It matters not whether the combination takes place rapidly or slowly—at a high

or a low temperature. The amount of heat liberated is a constant quantity, and increases or diminishes with the quantity of oxygen introduced by respiration. And one remarkable fact is worthy of notice: the temperature of the body of man, and of every warm-blooded animal, in a healthy condition, is the same, whether situated in a climate of high or low temperature. In a cold climate, however, the rapid disengagement of heat requires more food than a warm one, or an equivalent, either in clothing or heated rooms, which will diminish the urgent demand for such food, and will lessen the activity of the vital forces in the manner experienced in a warm climate.

A person from a cold climate, visiting a warm one, finds his appetite diminished, and may attempt to improve it by taking stimulants containing carbon, as all alcoholic drinks do. The temperature of the atmosphere is so high that he is disinclined to take exercise in order to increase respiration, consequently the whole amount of carbon is not consumed, and disease ensues, most commonly from an accumulation of bile. An explanation of this will be given in a future chapter.

CHAPTER II.

INFLUENCE OF CLIMATE ON THE SICK, AND THE BENEFITS DERIVED FROM VEGETABLE DIET.

Climatic influence on Invalids—Citizens benefited by going to the country in the warm season, and by strict adherence to a vegetable diet—Pernicious qualities of stale fruit and vegetables.

A FAVORABLE result is usually obtained by sending the sick, especially those laboring under diseased lungs, to a southern clime. The lungs, being in a measure disorganized, fail to obtain in a cold climate sufficient oxygen to consume all the carbon produced from the food taken. In a warm climate, however, the diseased organs have sufficient power to place the diminished amount of food which is there taken in equilibrium with the inspired oxygen; whilst in a colder zone the organs of respiration themselves would have been consumed in furnishing the necessary resistance to the action of the atmospheric oxygen. Thus it is, that pulmonary and inflammatory diseases are those which arise from an excess of oxygen, and are most frequent in a northern region. On the contrary, bilious or liver diseases are most prevalent in warm climates, as they arise from an excess of carbon—bile consisting chiefly of soda and carbonaceous matter. This applies to all warm and confined locations, crowded cities, etc. And thus it

is that people are benefited by leaving them in warm weather, and resorting to the sea-shore or open country, where sufficient oxygen can be obtained to consume the excess of carbon; but which, however, can only be fully accomplished by a strict adherence to a vegetable diet.

Such a change is of the utmost importance in the improvement of our health, especially the health of our children, as it is only in the country that ripe fruit can be obtained, uncontaminated and free from the putrid vapors which arise from the decomposing masses of vegetable and animal matter in our shops and markets, and which poisonous vapors are so readily absorbed by fruit. A few hours' exposure thereto is sufficient to injure the wholesome qualities of fruit or vegetables, and forty-eight hours suffice to make them deleterious. The fruit sold in large cities is often rendered really pernicious by venders mixing that which they have purchased on the previous day with their new supply, so that they can pass it off for fresh. There are honorable exceptions, of course; but it is requisite that purchasers should be on their guard as much as possible. The same may be said of vegetables as of fruit. Vegetables, too, are frequently received in large quantities or bulk from great distances, and decomposition has taken place while in transit; and they are then kept in boxes and barrels for a day or two before they are sold, increasing in injuriousness with every day's delay. It is thus that we are deprived of the advantages obtainable from the very means provided by a bountiful Providence for the benefit of our health in the summer season.

During the winter months we indulge in carbonaceous food, as we have a sufficiency of oxygen to consume it. In the spring season, our system has accumulated an excess of carbonaceous matter, which predisposes us to disease; but in ordinary good health we possess within us means of resistance—a power of adaptation to circumstances which saves us from an immediate attack of sickness, that eventually must ensue, if not contended with. We can readily be restored to a state of equilibrium, if we are not deprived of the means provided—fresh fruits and fresh vegetables—for our principal diet during warm weather.

So far, we have been considering the chemical action upon the blood which takes place in the lungs, and prepares it to supply nutriment to the general organization. It is here that the carbonaceous matter is separated from the blood, and *that* which has been thrown off from the several organs, by change of particles, is rendered useful, for it is consumed in the lungs, and thus eliminates heat sufficient to maintain the natural warmth of the body, and to preserve an equilibrium conducive to good health.

CHAPTER III.

THE FORMATION OF LIVING ANIMAL MATTER—THE NECESSARY FOOD FOR THE YOUNG.

The component parts of blood as derived from food—Carnivorous and graminivorous animals considered in relation to food—The young obtain from milk all that is essential to growth and vigor.

WE will now take into consideration the several component parts of vitalized blood, prepared to make up the living organism of the body—namely, the nerves, muscles, and bones, the elements of which are contained in the blood, and have been derived from food. By the examination of the blood, chemists are enabled to inform us what food contains the greatest amount of nutriment or animal matter; for, by a very simple process, some of the component parts of blood are detected, or can be separated.

Blood, taken from a vein, if allowed to stand for some time, coagulates and separates, when a yellowish liquid called *serum* arises to the surface, and a gelatinous mass is formed, out of which soft, elastic fibres, called the *fibrin* of the blood, can be drawn by a stick, to which they will adhere, if it is passed several times through the mass. This *fibrin* is identical in all its properties with muscular fibre—it is, in fact, muscle, ready to be deposited and formed into shape. The remaining portion of the blood, *serum*, contains

all the properties of the white of eggs, and, when heated, coagulates and is converted into a white elastic mass called *albumen*.

Blood contains seven chemical elements, among which are nitrogen, phosphorus, and sulphur; as also, lime to form the bones, iron, the coloring matter of blood, several combinations of soda and potash, and carbonic, phosphoric, and sulphuric acids. The two most important parts of the blood which invite our attention are albumen and fibrin. The vital forces or living principle can change one into the other, and convert either of them into blood. Both contain nitrogen. All portions of the animal body that have a decided shape contain about seventeen per centum of nitrogen; and carbon, oxygen, and hydrogen are also present. The two latter are separate, and not in proportion to form water.

All kinds of food proper for nourishment must contain nitrogen, for the organs can not create it, nor is it absorbed from the atmosphere in the lungs. Water and fat are devoid of nitrogen. The inorganic constituents of the body are iron, lime, magnesia, common salt, potash, and soda.

We have thus far described the most important constituents that form the living body, and will now take a comparative view of some of the changes which occur in organized matter taken as food by carnivorous and graminivorous animals, in order to ascertain what constitutes the nutriment of the food of man. The food which carnivorous animals take for nourishment is identical with those parts of their own organization which are to be renewed. It consists of the blood

and flesh of the graminivorous, but not of hoofs, hair, feathers, and bones, and is as readily assimilated as it is in man. This food, being decomposed, affords all that is necessary to sustain the system. The process of nutrition in graminivorous animals appears quite complicated. Their digestive organs are less simple than those of the carnivorous; but this appears necessary, when we take into consideration the fact that, in order to give the amount of nutriment necessary to sustain the system, vegetables must be eaten in much larger quantities than animal food. Of vegetable food, seeds of the different kinds of grain, and roots and juices give the largest amount of nutriment in proportion to the bulk eaten. The nitrogenized forms of nutriment in vegetables are reduced to three substances, two of which are soluble in water and one is insoluble. These can be distinguished in the following manner:

In nearly all vegetable juices, a separation takes place if they are allowed to stand for some time. A gelatinous precipitate, commonly of a greenish tinge, is deposited; and when this deposit is acted upon by liquids which remove the coloring matter, the residuum is of a grayish white substance. This is one of the nitrogenized compounds of vegetable nutrition, and it is known as *vegetable fibrin*. The juice of grapes is especially rich in this constituent, but it is most abundant in wheat and other cereals. It may be obtained tolerably pure from wheat flour, by a mechanical operation of washing out the starch, and is then called *gluten*; but the glutinous property does not belong to vegetable fibrin, but to another substance found

only in wheat. Vegetable fibrin is identical with that found in the blood.

The second nitrogenized compound remains dissolved in the juice after the separation of the fibrin, and can be coagulated by boiling. When the clarified juice of vegetables—such as cauliflower, asparagus, and turnips—is boiled, a coagulum is formed like that from the resume of the blood or white of eggs. This is known as *vegetable albumen*, and is found most abundant in oily seeds and nuts.

The third nitrogenized constituent of vegetable food is especially interesting. It is chiefly found in peas and beans, and in leguminous seeds generally. It is termed *vegetable casein*, and, like vegetable albumen, it is soluble in water, but it can not be coagulated by heat. When the solution is heated, a skin forms on its surface, and the addition of an acid causes a coagulum, the same as when it is added to animal milk.

These three nitrogenized compounds — *vegetable fibrin*, *albumen*, and *casein* — are the true nitrogenized constituents of the food of graminivorous animals, and contribute largely to the increase of mass in the animal body. Thus it seems that vegetables obtain from inorganic matter elements to form organic substances for the food of graminivorous animals. And these animals, in turn, form food for the carnivorous, or animals that can only subsist on animalized matter, which is first obtained from the vegetable kingdom. Therefore, animal organism is a continuation of vegetable life. The first substance capable of affording nutriment to animals is the last product of the creative energy of vegetables. There are sub-

stances in the animal system, such as sugar, starch, gum, pectine, etc., which contain no nitrogen. Without these, graminivorous animals can not subsist; at least one or more of those compounds is necessary.

Milk is the nutriment of the young, both of graminivora and carnivora. It contains *casein*—a nitrogenized compound, which supplies not only nitrogen, but the chief constituents of blood and the earth of bones, in a very soluble form, capable of reaching every part of the body—as well as sugar, butter, starch, and gum, each of which substances contains carbon and hydrogen, in almost exact proportion to form water, into which they are readily changed. Heat is also eliminated from milk, and the organs are thus saved from being consumed by oxygen in breathing, for the demand for carbon must be supplied, as the want of it causes death by starvation. If carbon is not supplied to the lungs from food or carbonaceous compounds in the system, other than what are in combination with fibrin and albumen, the substance of the muscles will be consumed at the expense of the substance of the system—that is, after any accumulated fat, that may have been deposited, and which may be considered a reserve of carbon, has been expended. In the change of matter which takes place in the system, the liberated nitrogen unites with hydrogen and forms ammonia, (commonly called hartshorn,) which passes off in the secretions and excrements.

We learn from the above that graminivorous animals do not obtain from the returned particles of organs, sufficient carbon for the action of the lungs, and

that their equilibrium would be destroyed if it were not for the sugar, gum, starch, and pectine that make up the deficiency; all of which products are readily obtained from vegetables. The carnivora obtain an excess of carbon in their food, and do not require to procure it from other substances. Bile, composed of carbonaceous matter and several salts separated from the blood in the liver, is again returned to the circulation, and, if not in undue quantity, is essential to a healthy condition of the system. It must be considered as one of the secretions that contribute to the formation of animalized products, like to the carbon given off in combination with oxygen in the form of carbonic acid, except that the salts contained in the bile are appropriated to their required use in the animal economy.

CHAPTER IV.

THE GENERAL FOOD OF MAN.

An examination of the general food of man—Fibrin and Albumen are products taken up by the blood, whether from vegetable or animal food—Mixed food most suitable for man—Carbonaceous food predisposes to fat and bile.

MAN partakes of both vegetable and animal food. The compounds obtained from vegetable food are similar, whether eaten by man or the herbivorous animals—namely, fibrin and albumen, which are nitrogenized compounds containing car-

bon in an animalized form. Fibrin and albumen are products ready to be taken up by the blood for distribution to all parts of the system, and are identical with what is obtained from animal food; but a very large amount of vegetables must be eaten to obtain a small quantity thereof; and, consequently, a greater activity of the digestive powers is required than would be demanded by the amount of animal food that would produce the same result. This activity calls for an expenditure of carbon commensurate with the activity. If the digestive organs are not very vigorous, a deficiency of this element must be the result; but if there is fat in the system, carbon will be supplied from that source. Hence fat, it would appear, is deposited to meet such an emergency. This fat is very similar to some of the component parts of casein, which contains fibrin and albumen in a soluble state, as well as butter, sugar, gum, etc. The three latter substances are formed of carbon and hydrogen in varied proportions, but are readily resolved into each other. Starch is also changed into sugar, and any of these vegetable products is easily converted into fat, which, when decomposed, gives off hydrogen. Hydrogen unites with oxygen to form water, and with nitrogen to form ammonia. The residue of carbon supplies respiration and adds to the formation of fat.

In an infant there is not such a rapid change of particles of the organized system as in an adult; consequently, there is not so much carbon obtained from that source; but in the former there is an actual increase of size, which continues until it reaches maturity. The deficiency of carbon is supplied from the

non-nitrogenized substances found in the casein—namely, butter, sugar, and gum—while the soluble nitrogenized substances—fibrin and albumen—are distributed for the sustenance and increase of the growth of the child.

In a man compelled to live on animal food the carbon would be furnished by the flesh, instead of by the butter, sugar, starch, and gum afforded him in a vegetable diet; and would require, comparatively speaking, a very large amount of flesh. An important fact to be considered here, is, that flesh is not decomposed merely for the purpose of yielding carbon, like butter, sugar, starch, and gum, but it forms organized matter containing all the properties of blood. It is distributed to the general organization, and has to undergo the changes of all vitalized matter, which is thrown off after it has accomplished what it was designed for—the sustenance of the organization—and is replaced by other vitalized matter before it can supply carbon for respiration. To accomplish this, muscular motion is required to create activity in the system. Carnivorous animals are compelled to take exercise, probably by instinct, in order to be saved from disease. Witness the lion, tiger, and hyena, when confined in cages; they are in constant motion. So with man; if he lives solely on flesh, it is necessary for him to take exercise, otherwise he becomes diseased.

It is then apparent that a mixed diet, with proper discretion, is most conducive to good health; and that, if varied judiciously, it will cure most of our ailments. If we eat to excess butter, sugar, or vege-

tables containing much starch, without inducing rapid breathing to get rid of a superfluity of carbon, bile or fat will accumulate—probably both. This is very injurious, as such accumulation produces some of the most formidable diseases that the physician has to contend with, one of which is diabetes. Sugar can be formed in the system from all farinaceous food eaten; and when the disposition to form it is once established, it is not easily changed, although an animal diet may be strictly adhered to. The carbon liberated from animal food unites readily with the free hydrogen, and sugar is thereby formed; while the nitrogen unites with hydrogen and produces ammonia, which passes off in the form of ammoniacal gas.

In the graminivora there is a tendency to the deposition of adipose matter. When it is desired to fatten an ox, hog, or any of the domestic animals, they should be confined in a warm stall, so that the expanded bulk of air to be breathed may not contain so much oxygen as it otherwise would. When thus confined, their activity in breathing is lessened, and the animals will consume more nitrogenized compounds, in the form of fibrin and albumen, than is required for the reproduction and supply of carbon to the lungs. In addition to this, they will eat a large quantity of substances that are devoid of nitrogen, such as starch, sugar, and gum, which yield carbon readily, and are not required for respiration and heat. Warm apartments and want of exercise are equivalent to a deficiency of oxygen. Under these circumstances the animals absorb much less oxygen than is required to convert the carbon of the substances,

usually, or under ordinary circumstances, destined for respiration, into carbonic acid; and a comparatively small portion is thrown off in excrementitious matter. The remainder is reunited with hydrogen to form fat, which, in the normal state, only appears in small quantity as a constituent of the nerves and brain.

A hog fed on highly nitrogenized food increases in muscle or flesh; when fed on potatoes, in consequence of the quantity of starch they contain, it gets very fat, with little increase of flesh. The milk of the cow, when stall fed, is rich in butter; but when the cow is turned out to pasture, her milk contains more casein, and in the same proportion, less butter and sugar. In woman, beer and farinaceous diet increase the proportion of butter and fatten the child; but, if she partakes of animal food, though she yields less milk it contains more casein, and the child becomes muscular and vigorous.

This is the experience of Liebig, and of many other eminent chemists who have tested the truth of his statements. It is the result of discoveries made in that branch of the science of chemistry which is applicable to physiology—made with all the zeal and ambition by which learned men have been led to oppose innovation and to detect error. It is a result which has enlightened the world with facts in physiology—facts that are made comprehensible by their agreement with the well known laws that govern chemical combination, and the knowledge of which is made subservient to vital force in the formation of organized *tissues* and the performance of their functions.

CHAPTER V.

THE VARIOUS TISSUES THAT CONSTITUTE THE HUMAN BODY—VITAL FORCE OR LIVING POWER.

Bichat's enumeration of the various tissues that constitute the entire form of man—Muscular motion dependent upon vital force—Means of expending vital force, and assimilating it.

WEBS, or, in physiological parlance, tissues, indicate the several peculiar parts of organs which form the animal body. BICHAT assigns the term to all the solids of the body, and makes a total of twenty-one tissues. These are as follows:

1. Exhalent—numerous small vessels throwing off matter.
2. Absorbent—numerous small vessels taking up matter.
3. Cellular—the receptacle of fat.
4. Arterial—blood-vessels conveying the blood outward.
5. Venous—blood-vessels returning the blood.
6. Nervous—animal, voluntary.
7. Nervous—animal, involuntary.
8. Osseous—relating to the bone.
9. Medullary—brain, etc.
10. Cartilaginous—white ends of bones.

11. Fibro-Cartilaginous—tendons.
12. Fibrous—muscular fibrin.
13. Muscular—the means of motion. Flesh cords that contract or extend, and give form to the body.
14. Muscular Organic—heart, stomach, etc.
15. Mucous—lining membrane of nose, throat, etc.
16. Serous—secreting membranes.
17. Synovial—secreting membrane about joints.
18. Glandular—organs forming secretions.
19. Dermoid } —relating to the skin.
20. Epidermoid }
21. Pileous—hair, etc.

The various organs that constitute the animal economy perform their functions from the force of a peculiar power, known as the *vital force;* which force subjects natural laws to its control, and diminishes in power in direct ratio to its expenditure. We have already stated that this vital force or living principle is as incomprehensible to our perception as the force of electricity or magnetism, which, under certain circumstances, produces a somewhat similar effect, especially in relation to motion produced in the animal body. We can only perceive the effect realized —action and motion.

Action of the mind or will produces voluntary motion. Involuntary motion, such as the circulation of the blood and the digestive organs, is produced independent of the will; but for power of motion it is dependent upon the vital force, for all motion of the animal system is dependent upon that living principle and the organism upon which it acts. This organism

requires a constant supply of sustenance—material that is acted upon to produce force, which is exhaustible and consequently requires renewing.

A man exhausts vital force by mental and muscular exertion. When walking, his erect position and action of lifting the legs from the earth are opposed by gravity; but, in consequence of the vital force having the ascendency, the legs are lifted alternately from the earth, and the resistance of gravity is overcome for a time. The same result accompanies all exertion, just so long as a sufficiency of vital force is supplied; and, as this force is accumulated in the animal economy, it is limited in direct ratio to the amount of aliment eaten and properly digested; the force, in fact, being dependent upon the change of matter in the system, induced by motion and exertion. Motion and exertion increase the ability to accumulate power to the extent of the animal development. As exhaustion follows exertion, rest is necessary to the accumulation of vital force; and, if exertion and rest are both well regulated, an equilibrium of force and development is established and made manifest, often to our astonishment. Extraordinary muscular power is obtained under favorable circumstances; which favorable circumstances may be considered as the partaking of wholesome food, residence in a congenial climate, well-regulated habits of eating, thorough mastication of the food, and the consumption of no more than is required to sustain the muscular force to be exerted. The benefit of such precautionary measures is indicated by an invigorated disposition in twenty minutes after eating, and the absence of that drowsy dullness

which follows over-eating and invites a *siesta* or short sleep. The latter condition induces a concentration of vital force in the stomach, so that it may digest the excess of food, which is done at the expense of the general system.

CHAPTER VI.

INFLUENCES OF CLIMATE AND ATMOSPHERIC ELECTRICITY.

The influence of climate on the animal system—Means of adaptation to unfavorable circumstances—The electrical condition of the atmosphere—A sufficiency of electricity an excitant to man's energy, and the reverse when there is a deficiency—The influence of a deficiency of electricity in the atmosphere.

CLIMATE exerts a powerful influence over the animal economy. The maintenance of good health under unfavorable circumstances requires, as we have before intimated, the exercise of good judgment and care. In a cold, condensed atmosphere we inhale the greatest amount of oxygen. This calls for an increased activity in the change of matter in the system, in order to produce a sufficiency of heat; and, consequently, an increase of nutritious food and warm clothing is required. The rule applies to all degrees of temperature to which man may be subjected.

In whatever place man may reside, the atmosphere is variable in temperature and quality, being cold at one time and moister and warmer at another, and his system is subject to its influence. In chronic diseases

his discomfiture is manifested at every change; and a diseased joint, an old wound, or a mutilated limb will indicate change in the weather some time previous to its occurrence. It is not only the fact that a morbid condition of the system renders an individual so susceptible, but it is equally true that the healthy are also subject to the same influences, and require an increase of vital force to resist them and thus escape the actual injury which would otherwise ensue. The impress is clearly perceptible in the countenance, and is evinced by the disposition of the most vigorous. A depression of spirits is apparent in all who do not possess sufficient vital power to repel its approach, which depression increases in degree from the nervo-sanguineous to the atrabilious temperament; and in the latter the despondency is so great that the person afflicted labors under actual melancholy, and is often led to the committal of suicide. The sombre state of the atmosphere which tends to so sad a result has been not inaptly designated "suicidal weather," from the fact that it has been noted in both England and France that a greater number of suicides take place in the month of November, when such weather prevails, than in any other throughout the year. This peculiar influence of the atmosphere was noticed by the ancients, but up to the present time it has never been satisfactorily explained. It can not be owing to the sun being obscured by the clouds that the sad effect is produced; for, if such were the case, a perceptible change would be observed during the night, especially in people of melancholy dispositions. It can,

therefore, be only attributable to a peculiar condition of the atmosphere.

That the electrical condition of the atmosphere tends to produce a very decided effect is quite apparent. We feel it in the depression of our energies, and we observe it not only in children who consequently become irritable and indisposed to play, but in the cattle in the field and in the fowls about the barnyard when they huddle together and droop their heads with drowsiness; and we further witness it in the countenances of our usually gay friends, for it causes their faces to assume a dull aspect which is quite at variance with their wonted nature. At such times the electrical machine will fail to produce the usual quantity of electricity—we refer to the electrical machine which collects electricity from the atmosphere by friction upon glass, and condenses it in the metallic insulated conductor, (a means of obtaining atmospheric electricity,) the effects of which upon the animal economy are quite different to those produced by magnetism, electro-magnetism, or galvanism. The three latter seem to be afforded from metal directly, and are increased by decomposition.

It is the experience of the author of this work that *atmospheric* electricity is decidedly the most effectual in its curative tendency; that it gives increased tone to the nerves when applied in a continuous current, and that when interrupted it produces excitement. When a constitutionally delicate person is insulated and charged with atmospheric electricity, if that electricity is drawn off by metallic points for ten minutes, it will, in some instances, produce fainting; and the

same operation will produce in all persons a depression of energy and a tendency to relieve local congestion. As it is necessary that the modes in which atmospheric electricity is applied must be varied to suit the peculiar constitution of the patient and the particular nature of the disease, it must be inferred that, to insure safety and success, experience and judgment must be exercised in the application. It is not safe, then, to apply it without the advice and care of a skillful physician; but, under such advice and care, it may be employed to most decided advantage in such cases as the removal of tumors, the restoration of suppressed secretions, the loss of power — as in paralysis and the consequent deformity—and in rheumatic and neuralgic affections.

The changes in the electrical condition of the atmosphere just previous to and after a heavy thunderstorm are very marked. Before the storm all animal creation seems to be depressed, and persons feel very languid from the oppressive atmosphere and the high temperature — the thermometer marking ninety degrees, and scarcely a cloud to be seen. On trying the electrical machine at such a time, not a spark of electricity can be produced, which is an unmistakable sign that a storm is approaching. After the storm, with the thermometer still standing at ninety degrees, all feel exhilarated, and express themselves delighted with the purity of the atmosphere, and the electric machine indicates a very great increase of electricity. This exhilaration manifests a resuscitation of a wanted power, and is a stimulus to the nervous system.

It has been observed during epidemics, as, for in-

stance, on the several occasions when epidemic cholera prevailed in this country, that there was a very great deficiency of atmospheric electricity, and that the electricity increased in direct ratio with the decline of the disease. The same result has been noticed in endemic disease. In unhealthy localities, such as marshy districts of country, when yellow-fever, intermittents, and kindred diseases of a low grade supervene, these proceed from the action of local causes, which produce a deficiency of electricity and consequent nervous depression, and a derangement of the circulation of the blood, both of which are occasioned by the excessive evaporation of water in the heated season producing a chilliness in the night.

CHAPTER VII.

LOCAL INFLUENCE FROM HEAT AND MOISTURE, AND THE INFLUENCE OF COLD.

Heat and moisture—The disturbing influence of electricity in the atmosphere—Similarity of results in vital force in the resistance of atmospheric influence and in the accumulation of muscular power for labor—Means of sustaining the animal system under the influence of cold—Variations can be made conducive to improvement in health.

WATER, in the form of vapor, deprives the atmosphere of electricity and heat. The result is a rarefied condition of the air, caused by the absorption of heat from all surrounding bodies; and, after the sun has declined below the horizon, a con-

densation of vapor ensues—a law of nature well understood by all chemists. This leads to a chilliness of the superficies of the body; and, warmth being essential to the maintaining of the circulation of the blood in the skin, the internal organs become gorged, and remain so until some influence, as that of the returning sun, warms the body. Thus an alternate action of influx and reflux of the circulation is produced, which induces disease, such disease being, if the two influences are not excessive, at first of a periodical character, as that of intermittent fever. But if, on the contrary, the influences are excessive, the virulent forms of disease ensue, and more especially attack persons who are unacclimated. Under such circumstances, and under similar exposure, the inhabitant may only have an intermittent while the visitor will be seized with a typhoid fever, the system of the first being somewhat adapted to resist this extraordinary influence, from his having had previous attacks in a milder form.

This vital power of resistance is cumulative, but it requires time to accumulate. The law of nature which here operates is similar to that by which vital force is gradually increased, so that, in course of time, a man is enabled to acquire sufficient strength to perform the most arduous labors with apparent ease. Take, for example, men of equal development of muscle, one a clerk and the other a blacksmith; the clerk would be unable to wield a ten pound hammer for an hour, while the blacksmith could ply it for hours with impunity. The power possessed by the blacksmith could only be acquired by the clerk after six months' judicious exercise; for it would require an in-

crease of activity in the organism of the system and a more rapid change of matter, which would necessitate a special disposition of the vital force. And that a different appropriation of the vital force is required, is evinced in the well-known fact that many men who labor but little consume more food than those who are constantly at work, yet they do not obtain muscular power as a result. In such cases the resultant power from the proper elaboration of the food is probably exercised in the digestive process, and the excess of matter thrown off in the excreta—that is, when bile and fat do not accumulate.

Here we would call special attention to a knowledge of the fact that such indulgence is unnatural and carries with it its own punishment, that of *ennui*, a deplorable condition, for it tends to paralyze all the greater feelings by excess, and to torpify all the finer by disease. People who thus indulge eventually become both disgusted with this world and indifferent about the world to come, and not unfrequently lay violent hands upon themselves, for they find life a burden and are worse than useless to society. It is sad to contemplate that such persons are often naturally possessed of fine mental as well as physical endowments, and that they cast away the precious gifts not only intended for their own happiness, but bestowed upon them in order that they may benefit their fellow-beings; for it is a responsibility required of us all by our Creator, that, when thus favored, we should contribute to the best of our ability to the happiness of our fellow-men. The penalty that is sure to follow this unnatural indulgence, even if it is practiced in a

moderate degree, should deter us from giving way to it, for bad habits are readily acquired, but not so easily controlled when it is our desire to repel them.

The preceding remarks apply more directly to the inhabitants of our temperate zone. In the colder regions, the consumption of nutritious oleaginous food is necessary to enable man to keep up the animal heat and to resist the cold. In the extreme north, the atmospheric influence is so great that an extraordinary effort of the vital energy is required to prevent the termination of life by freezing. The vital force is, under these circumstances, actively exercised in the digestive and assimilative processes, and rapid changes of matter are thereby induced. Food containing the greatest possible quantity of carbon—such as pure fat, train-oil, etc.—is required to sustain the increased activity for the supply of heat; which activity is caused by the action of oxygen uniting with carbon, and is increased in consequence of there being an increased quantity of the latter produced from the carbonaceous food, and an increased quantity of oxygen in the condensed cold atmosphere. Hence the necessity for taking this very nutritious food. The quantity of oxygen inhaled in a cold atmosphere far exceeds the amount taken in in a warm atmosphere, although, in both, equal volumes, by bulk, of air are taken in or inhaled. Consequently, a cool atmosphere sharpens the appetite. The increased quantity of oxygen inhaled, soon reduces the ordinary quantum of carbon, and induces a more rapid change of matter; and the result is, that if food is not supplied equal to the demand, the organism is acted upon, and

the system becomes enfeebled. This is the process that causes starvation. A person will starve in a cold climate much sooner than in a warm one, because the oxygen inhaled actually consumes the system in exact ratio to the quantity inhaled.

And here again we have before us an important established fact, namely, that the variations in the atmosphere make a very decided impression upon the animal economy. However, if those variations are properly considered and turned to account, they may be made conducive to the improvement of bad health, and may afford a means for invigorating enfeebled constitutions and establishing a tolerable condition of health.

CHAPTER VIII.

CITY LIFE PREDISPOSES TO SCROFULA—THE INJURIOUS EFFECTS OF DRAUGHTS OF AIR.

The influence of city life in inducing a scrofulous diathesis—The various unfavorable and unavoidable difficulties that exist—The formation of tubercles under certain circumstances—The serious injury sustained by the human system from concentrated draughts of air, and the means of obviating the influence.

IT has long since been observed by medical writers that it is in large and densely populated cities that scrofulous tendencies predominate. Scrofula is nothing more than an enervated condition of the organism of the system; and it is more especially in

cities that carbonaceous matter accumulates to excess. The results of the latter are morbid secretions, which derange the glandular tissues, the spongy bones, and the substance of the lungs and liver, and produce the formation of tubercles in those tissues. These little spherical concrete bodies have for a nucleus carbonaceous matter, enveloped and in a quiescent condition. They are thus rendered dormant, and, notwithstanding their presence, a tolerable condition of health is maintained, and, in some instances, an accumulation of fat takes place. Children often possess well-developed muscles and a rotundity of form, and yet have, at the same time, enlargement of the joints, which evinces an abnormal condition of the spongy portions of the bones—a direct indication that there is a lodgment of tubercles in their interstices, as well as a derangement in the assimilative process.

In some children there is a tardiness of teething, which indicates a want of ossific or bone pabulum; and thus a yielding condition of the long bones of the legs, and, from the strength of the muscles, a curvature of these bones is produced, which curvature is increased by the superincumbent weight of the body. Bow-legs is the result. If a child, laboring under this abnormal condition of health, is slightly bruised, an inflammatory disposition is induced, which exhibits itself in local inflammation, with a tendency to suppuration from the acrid secretion that exists in the system, and has previously indicated its presence by an eruptive tendency, but which, however, will now cease, in consequence of the secretion concentrating in the excited part—the ankle, the knee, the hip, or

the spine. And, after the local inflammation is decidedly established, an acrid discharge, that may have previously come from the nostrils and ears, will also cease, and the enlarged glands at the angle of the jaws, and the enlarged tonsils and eruptive sores upon the skin, will all likewise disappear. The development of matter, which distends the diseased part, soon destroys a portion of the integument, and an excessive drain takes place at the expense of the general system to sustain such drain. If the first impression has not been so severe as to enfeeble the assimilative processes, the most nutritious and easily digested food must be resorted to in order to promote digestion and sustain the system. The greatest possible amount of oxygen should be inhaled, without subjecting the patient to chilliness, as by chilliness the skin becomes enfeebled and can not resist the influence of cold to repel the blood from the surface, which failure of resistance produces a torpidity of one of the largest organic tissues in the system—the skin—and thus tends to increase excitement in the diseased part. The curative indications are, the sustaining of the system by nourishment, properly selected with a view to its being readily digested and assimilated, and the diffusion, by every judicious and possible means, of this local excitement. For the better accomplishment of this desirable object, medicine, judiciously chosen and administered, is of great value.

The advantages to be obtained from an atmosphere well charged with oxygen are great; but care must be taken to obtain those benefits under the most favorable circumstances. The patient must not be

exposed to a concentrated draught of cold air, as it robs the system of its vital energy much more rapidly than that energy can be generated, and has a debilitating influence far exceeding the advantages to be obtained from the increased quantity of oxygen taken into the system. If so exposed, the activity created by the chemical change which takes place, from the uniting of oxygen with carbon—evolving heat—would be expended to maintain the demand for heat; and, if the patient is very feeble, the organism would have to furnish the deficiency. Consequently, a favorable location must be selected in the country, and the room occupied by the patient kept in temperature congenial to his or her sensibility, while attention must be given to warm clothing. In addition, the skin should be frequently cleansed and excited by wearing coarse flannel, and the extremities should be chafed with the warm hand, especial care being taken to keep them at all times warm.

The remarks here made relative to the effects of a draught of air are equally applicable to all conditions of life, and in degree to the ability of resistance to the influence, and they should be carefully observed by delicate persons. If warmly clad, out-of-door exposure in a dry, cold atmosphere, and especially when regularly resorted to, is very conducive to good health. The reverse of this is the consequence in a cold, damp atmosphere; for moisture, in the form of vapor, is a rapid absorbent of heat, and robs the system of its vital energy, in direct proportion to its inability to resist the unfavorable influence.

CHAPTER IX.

PROSPECTS OF RELIEF TO SCROFULOUS CHILDREN.

Relative prospects of relieving scrofulous children—The means of curing scrofula—It can be eradicated.

IT is requisite that children, laboring under discharging abscesses, which weaken the system, should be thoroughly sustained, and their organism maintained in its integrity. Sustenance is necessary to sustain the excessive discharges, which otherwise would reduce all the vital energy to a state of dissolution. But if properly supported, the sequence is a recuperative tendency, and this must be aided by the skillful adaptation of surgico-mechanical appliances for the prevention of deformity, which, if not thus guarded against, would result from the loss of parts; for, if the limbs or body are not kept in a normal position till a restoration of parts is accomplished, the diseased parts heal in their contracted condition, and the deformity produced is, in many instances, incurable. Persons thus situated are subjected to the impositions of vile pretenders, to whom they resort in the hope that a cure may be attained by the use of some expensive mechanical apparatus; and thus undergo excruciating torture, only to increase their deplorable condition. The majority of these cases are

remediable by skillful treatment. They most frequently require a surgical operation first, and then the adaptation of properly constructed apparatus, made under the direction of an experienced surgeon, versed in the knowledge of the construction of surgico-mechanical means for the cure of deformity. In the incipient form of caries of the spine—that disease of the spine which results in humpback—a properly constructed support of steel springs, so arranged as not to press upon the diseased part, is very valuable. Motion and attrition promote active absorption of the spongy portions of the bones, which is one of the principal causes of the deformity. Such mechanical support is, therefore, of inestimable value in the treatment of this disease, both as a curative and a preventive of deformity; and by such auxiliary means, inflammation will be arrested in the affected joints, as those of the hip, knee, or ankle. To save scrofulous children from these deplorable results, we must treat them upon sound, rational principles; first, by considering their actual condition, and, secondly, by the resort to such invigorating and curative measures as will tend to relieve the morbid condition which has existed from their earliest life.

We do not entertain a doubt but that, in most cases of a scrofulous tendency, the organism was primarily at fault, and failed to perform its wonted functions in consequence of hereditary deterioration. This is a generally received opinion. It is also believed that the morbid condition can not be eradicated and a healthy one established; but from this view we must beg leave to differ, and for the following reason:—

With very few exceptions, children thus predisposed grow and develop in size and form quite equal to those who are not, and, by ordinary care, escape the terrible affliction through childhood, the disease being only developed in adult age, most commonly in the form of consumption. We must certainly infer from this fact, that the tendency to morbid derangements can be modified.

By ordinary care, even under the unfavorable condition of a city life, relief can be given to children who are hereditarily predisposed to scrofula, but in whom, however, after they have reached an age at which they are permitted the control of themselves, *and then only by some gross imprudence*, the latent morbid matter, known as tubercles, may be excited into an inflammatory condition, which will result in consumption. Now, as this tuberculous state can be rendered dormant by ordinary care, and can be kept so even under unfavorable circumstances, we entertain the belief that it can be eradicated, and are prepared to assert that it has been, under favorable conditions.

We have remarked, it is well known that individuals having decidedly scrofulous parentage have enjoyed most robust constitutions. This we must attribute to their having been nurtured, during childhood, under the most favorable circumstances, the tendency of which is, as it is in the animal economy during growth, to throw off and resist all morbid influences. Such is an undeniable fact, often realized by sending children out of our large cities for the improvement of their delicate health. And that desirable object is almost invariably obtained without any special

care, other than pertains to a country life—the advantages of a different atmosphere, plainer diet, more regular habits in eating and sleeping, and less extraordinary excitement. Yet all of these advantages might be secured in a city home, with the single exception of the atmosphere, which, in the country, is purer, and in a more condensed form and higher electric condition. If, however, these conditions of the atmosphere do not exist in that part of the country resorted to, then there is nothing to be gained by sending a feeble child or an invalid adult out of town that could not be obtained in the city. And thus it is that many delicate children are enabled to enjoy tolerable health in the city, and even to become robust. In making these remarks, we have reference to a general feebleness, or want of stamina in the organism, unattended by disease of the lungs.

CHAPTER X.

DELETERIOUS INFLUENCES AND DISINFECTANTS.

Unfavorable condition of the atmosphere in densely populated cities—Deleterious influences engendered by carelessness—Disinfectants, and the proper methods of applying them.

THERE exist in all large and densely populated cities, and in other cities in proportion to their density of population, unavoidable causes of deterioration of the atmosphere, even under the most favorable condition of the weather. There is the diffusion of an

excessive quantity of water in the form of vapor—a powerful means of depriving the atmosphere of its electricity, which is a necessary stimulus to the animal system, and is essential to the maintenance of vivacity and vigor. And there is also a diffusion, or lightness of the atmospheric air, from the excessive quantity of heat required throughout the year for various domestic and manufacturing purposes. The last-named unfavorable influence can be modified by judicious ventilation and by keeping the apartments cool in winter, or never above sixty-five degrees of Fahrenheit, throughout the day. Sleeping rooms should be kept at a temperature of between thirty-five and forty degrees. Much of this debilitating influence can thus be obviated; for the atmospheric air will be so condensed that, when inhaled, it will afford sufficient oxygen to relieve the system of the accumulated carbon, unless a person has indulged in an excessive quantity of carbonaceous food, such as fat meats, gravies, butter, cakes, pastry, sweetmeats, sirups, alcoholic drinks, etc. An overpowering of the digestive organs, without a sufficiency of vital force to enable them to perform their wonted functions, causes a morbid action that impairs the whole system to such an extent as in some instances to terminate in paralysis and death.

One other prolific cause of disease in densely populated cities is most worthy of notice. It is that of a constant putrefactive fermentation of organized matter—vegetable and animal—which diminishes and increases in ratio to unfavorable circumstances. Among these unfavorable circumstances, the most predomi-

nant are: close, ill-ventilated apartments, insufficient drainage from dwellings, and the accumulations of substances which readily tend to decay, and are permitted by carelessness to remain in cellars, vaults, and sinks. From these sources there is generated an excessive quantity of poisonous gases detrimental to health; and from them even endemics and epidemics are sustained, but in direct proportion to the unfavorable condition of atmospheric influence, as, for instance, an excess of heat or moisture.

Living animal excreta, if permitted to accumulate by ill-constructed accommodations, generate an insidious and pernicious emanation which tends to impair the health, more especially of delicate persons. Latent diseases, as that of scrofula, are at times developed and maintained from this source of excitement, to the destruction of the unfortunate individuals thus exposed; and it renders the more healthy susceptible to the influence of any existing endemic or epidemic that may prevail. This easily accounts for apparently healthy persons, residing in what are, under favorable circumstances, healthy localities, being attacked by some predominant disorder, and, in some instances, for whole families falling a sacrifice to it.

It must be most readily perceived by the reader that this deleterious influence is only engendered by the inattention of the heads of families to an incumbent duty which devolves upon them, that of supervising the premises they occupy. Corrective means are within the power of the most humble occupant of an apartment, namely, cleanliness and disinfectants, which latter are readily and cheaply obtained

The price of a mug of beer, a paper of tobacco, or a glass of spirituous liquor would purchase a sufficient quantity of the chloride of lime to neutralize the foul emanations of a sleeping apartment in a tenement house for a week; that could be accomplished by placing a tea-spoonful every other day under the bed, and, when replaced by a fresh supply, throwing it into the chamber or slop-pail. Each family doing this would deodorize and destroy all the foul emanations that would arise from what must be considered unavoidable accumulations about such apartments, or, indeed, in any occupied dwelling—a precaution of especial importance in crowded cities. This chloride of lime is the most convenient disinfectant for families, and the least objectionable; yet to some its odor is unpleasant.

To disinfect sinks, water-closets, cess-pools, and sewers, sulphate of iron—commonly known as green vitriol—two ounces to the gallon of water, is the most effectual means, and should be used during the summer season twice a week in liberal quantities. Care should be observed in its use, as it leaves a permanent stain on white clothing. The burning of sulphur in apartments which are in a foul condition—infected with vermin or subject to mould or mildew—is the most effectual means known of cleansing and purifying them. The apartments, however, *must be unoccupied during the process*; and to complete it, the walls and ceiling should receive two or three good coatings of whitewash made from unslacked lime, into which should be thrown a handful of common salt, as it makes the material more effectual and adherent.

These applications will render the most unwholesome rooms perfectly innoxious for a time; but, if unfavorably located, and inhabited by careless, indifferent people, the process should be repeated very frequently, in order to insure a favorable condition of health, not only to the inmates, but to their neighbors. A collection of fermenting putrefactive matter will extend its influence to a whole neighborhood; hence, it must be inferred that cleanliness in every part of it is the only reliable protection to the inhabitants against the poisonous effluvia which arises from an accumulation of filth.

Home comforts, in an extended sense, comprise well-ventilated apartments, careful family discipline, wholesome food, comfortable clothing suitable to all seasons and atmospheric changes, and active exercise in the open air; and, to complete all, happiness and pleasurable enjoyment. If children are brought up under these influences, all scrofulous taint will be eradicated in less than three generations, although such children may never go beyond the suburbs of a city.

CHAPTER XI.

DANGERS ATTENDING EXCESSIVE EATING—WARMING AND VENTILATING APARTMENTS—CAUSES OF DIPHTHERIA AND CONSUMPTION.

People under favorable conditions become large eaters—Children require more food than adults—The importance of selecting suitable locations for country resort—The proper method of heating dwelling-houses and the means of ventilating them—How diphtheria and consumption are engendered.

THE reader is again reminded that the vital force can be accumulated, if time is given and a gradual increase of the quantity of food taken is observed and practiced. And so it is that persons will become large eaters with tolerable impunity, though somewhat dependent upon circumstances. But, in order to take in a sufficiency of oxygen to relieve the system of the resultant carbon, the secreting organs must be active, and the lungs must perform their functions well, or disease will ensue, and that frequently of a most serious character.

Some individuals possess a peculiarly active condition of the organism; and therefore, to sustain an equilibrium, they require a greater quantity of food than others not so constituted. In such persons the secretions are very active, and are indicated by the

soiling of their under-clothes. In adults this active condition of the organism is analogous to that of children in a healthy condition, with the exception that the excess in the latter is appropriated to their growth; and, if they are not properly supplied with food, not only will that growth be retarded, but their general health will be impaired. If children are under the influence of a bracing atmosphere in the country, the greater will be the impairment; but the reverse is the case if care be then taken to supply them with a sufficiency of wholesome food at regular stated periods. It is in this latter that consists the great advantage which accrues to a child's health when it is sent into the country, provided a suitable location has been selected, which is, after all, of the utmost importance.

To choose such a locality requires experience and judgment. To send a child laboring under an inflammatory condition of the system to a mountainous region or to high, cultivated table-lands would be adding fuel to the flame; while to send one of naturally good constitution, but enfeebled by some unfavorable circumstances, to a low, marshy district, would but weaken the child still more. From these considerations it will be readily perceived that, in many instances, it would be essentially necessary to select an intermediate region. This remark applies equally to invalid adults, many of whom have been seriously injured by the indiscriminate selection of country resorts—such as the rural abode of some relative or friend, or a fashionable watering-place—which conform to their desire rather than to what might be most conducive to the restoration of vigor. A more

potent remedial agency can not be afforded to invalids than that of a suitable atmosphere. It tends directly to establish the normal performance of the functions of the organism which are deranged, most commonly and more especially when domiciled in very populous cities, by unfavorable surrounding circumstances.

If apartments are properly ventilated, warmth obtained by means of steam or heated air can be rendered tolerable, even to the enjoyment of good health, comparatively speaking, and bearing in mind the other injurious influences ever existing in densely populated cities. If economy in the consumption of fuel as well as a ready distribution of heat to all parts of an ordinary dwelling are desired, the heating apparatus should be placed in the centre of the cellar. Large public buildings require more extensive arrangements, as much heat is dissipated by its being conducted in horizontal pipes to a great distance. However when a diagonal upward conduction is employed, the heat is not dissipated in the same proportion as it is in horizontal pipes; and consequently, from there being little, if any, loss of heat, it can thus be readily distributed to the upper stories of a building. If the main dividing partition of a house is built of brick, branches of heating flues can be distributed with safety. Each room of a residence or other building should have placed in the floor, on one side of the room, two registers for the admission of heat, separated at equal distances from each other and from either end of the room; and on the opposite side there should be two corresponding ventilating registers in the floor, connecting with flues extending to the top

of the house or building; and these ventilating flues, to be effectual in their operation, should serve only one apartment, otherwise an interference would ensue from the opening of ventilators above or below. A large hall or apartment should be constructed in a similar manner, having, however, a greater number of registers.

In rooms thus provided, the heat which rises from the floor will be diffused throughout them. The tendency of the heat will be to ascend, but, there being no outlet above, it will be diffused, and ample ventilation established by the two ventilating flues which have their egress above the roof. Under certain conditions of the temperature of a room, cold air will be furnished by one of the ventilating flues, and the heated air will pass out through the other. If the door is thrown open, then both ventilators will be engaged in conducting off the heated air; but if the door is kept closed, fresh air will be supplied to the room in the manner stated. The admission of fresh air in this manner is of great importance. Room doors often shut very close, and heated air is frequently kept confined for hours in an apartment, while, at the same time, it will be crowded with people, who are thereby exposed to most serious consequences. The ailments that arise from such exposure present various phases, which are but rarely attributed to the real source.

The ordinary mode of warming apartments by means of heated air is any thing but comfortable; and the effect is, as generally expressed, that "the feet are freezing while the head is over-heated." This is what might rationally be expected, with, as is most fre-

quently the case, a register for the admission of heated air placed a foot above the floor, and a ventilator about a foot below the ceiling. The consequence is that the heated air ascends to the ceiling and warms only the upper stratum of air, while the reverse should be accomplished, but it is impossible under such an arrangement. With registers and ventilators so situated, there is no possibility of equalizing the temperature of a room. If the ventilator is kept open, the heat will pass off, and the room will be uncomfortably cold. If closed, the air will become very impure, and the only relief will be to throw open all the inner doors and equalize the heat throughout the house. As this is not always convenient, the evil is endured, to the injury of the health, and particularly that of children and delicate persons.

Cold feet determines the blood to the vital organs, which conduces to congestion and inflammation of the lungs and brain. If those organs are predisposed to such ailments, the result must be, at least, most unfavorable. Here is the source from which have mainly sprung those violent inflammations of the throat that have been so very prevalent for the last few years—diphtheria and other congestive conditions of the mucous membranes of the fauces, larynx, and bronchia—and, in some instances, those bronchial affections that are not excited into an active condition until after months and years of alternate exposure to the predisposing influence. In the latter case, the superficial vessels become weakened by distention, and, owing to the exposure being repeated every winter, though relieved in the summer, never recover their

lost tone, but are, at last, under some extraordinary circumstance, excited into active disease of an incurable character; for the parts affected having been previously permanently indurated, the ultimate result is bronchitis.

When a tuberculous condition of the lungs exists, consumption supervenes at an early day. It is more than probable that tubercles are engendered in the systems of children from their being confined in apartments lighted with gas, and warmed by the ordinary means of heated air, with defective ventilation. Under such circumstances, the apartments are kept very warm; consequently there is a deficiency of oxygen to support healthy respiration, while an excess of carbonic acid gas is inhaled from the gas that escapes and is unconsumed by burning. And thus carbonaceous matter is permitted to be returned in the arterial circulation intermingled with the animalized matter for the sustenance of the organism, and is deposited in the parenchymatous structures of the soft parts and spongy portions of the bones. When such foreign substances are lodged in the living system, the tendency is to incase or cover them, and the granular cysts, known as tubercles, are thus formed; and this tendency is greater when the food consists largely of fats and other carbonaceous substances—of molasses, candies, and food containing much starch. Although bread is called the *staff of life*, yet it is never depended upon solely to sustain life and vigor. The diet of children, who are confined in rooms so unfavorable to health as those just referred to, should be lean meat in moderate quantity, bread, and milk that has had the cream taken off.

PART IV.

The Chemistry of Food.

CHAPTER I.

NUTRIMENT CLASSIFIED.

The food of man divided into two classes—Nitrogenized substances, or the articles that form blood—Non-nitrogenized substances, or the elements of respiration.

AFTER a thorough investigation of the subject, Professor LIEBIG divides the food of man into two classes—nitrogenized and non-nitrogenized. The former is capable of conversion into blood; the latter is incapable of such transformation. Out of those substances which are adapted to the production of blood all organized tissues are formed. In the normal state of health the other class of substances serves to support the process of respiration. The first may be called the *plastic elements of nutrition*—in other words, the animalized matter for replacing the particles of the organism which are being constantly thrown off; for, as stated in a previous chapter, a continual change of matter is constantly going on in the living animal economy. The last may be denominated *elements of respiration*, as they consist of those substances that, by their union with oxygen, form carbonic acid and water, which are thrown off in the breath, bile, etc., and that, by the same union, eliminate the heat of the body.

The articles of food which form blood are designated as follows:

Nitrogenized Substances.

Vegetable fibrin.	Animal flesh.
Vegetable albumen.	Animal blood.
Vegetable casein.	

And those carbonaceous portions of food, termed elements of respiration, which are commonly more or less combined with what we eat, but at times taken separately, are as under:

Non-Nitrogenized Substances.

Fat, from whatever source.	Pectine.
Starch, found largely in the potato.	Basorine.
Gum, readily converted into sugar.	Wine.
Cane sugar, in various forms.	Beer.
Grape sugar, contained in fruits.	Spirits.
Sugar of milk, as contained therein.	

The reader will bear in mind that vegetable fibrin, albumen, and casein, when separated from vegetables, are identical with fibrin, albumen, and casein obtained from organized animal matter; and that the difference between vegetable and animal diet consists in its being possible to make a selection of those vegetables which contain a less proportion of carbonaceous matter than is found in others. We are also able to avoid carbonaceous products that have been separated from vegetable and animal substances by art. To enable us to accomplish this, it has already been mentioned that we have reliable chemical analysis.

CHAPTER II.

THE ACTUAL NUTRIMENT OBTAINED FROM FOOD.

Chemistry in relation to man's normal condition of health—Organized elemental substances the result of vegetable life—Analysis of vegetable and animal substances used as food—Food designated for the seasons.

THE facts set forth in the preceding pages show that modern chemistry, by a rational exercise of reasoning in regard to man's normal condition of health, has taught us what is necessary for our proper sustenance and conduces most to development and strength; and which may briefly be stated as being—

1st. An accumulation of force in direct ratio to the expenditure.

2d. Nutriment for the production of that force.

3d. Carbonaceous food, clothing, and all ordinary means that support and sustain animal heat, under ordinary and extraordinary circumstances.

Strength is constantly being exhausted by both physical and mental exercise; while warmth is diffused in direct proportion to the variations of temperature, which are continually operating—for a uniformity of animal heat is essential to the sustenance of a normal condition of health. To obtain these in a rational manner, it is necessary that we

should acquaint ourselves with the component parts of the food we eat. And this is not so difficult a matter as might at first be imagined, as we have for our guidance the truths that have been established by our learned chemists, who have carefully analyzed the constituents of the animal body, and have determined what elemental substances constitute the vegetable organized substances that are essential to sustain the living animal economy.

The elemental substances, as gases in their simple forms, are actually noxious. They must be first formed by vegetable life into organized compounds, in order to constitute suitable food for man; and these are denominated primary compounds, or, by chemists, proximate elements. These primary compounds are furnished by animal and vegetable substances as food, and are divided into two classes, carboniferous and nitrogenous. The first class consists of carbon, hydrogen, and oxygen; the second, of carbon, hydrogen, oxygen, and nitrogen. The common substances which constitute or contain the gases of the first class are wood, starch, gum, sugar, and oil; and those of the second, or nitrogenous, are albumen, casein, and fibrin.

Wood, gum, and starch contain like proportions of gases: 12 parts carbon, 10 parts oxygen, and 10 parts hydrogen.

Cane sugar contains 12 parts carbon, 11 parts hydrogen, and 11 parts oxygen.

Albumen, fibrin, and casein contain each 40 parts carbon, 12 parts oxygen, 31 parts hydrogen, and 5 parts nitrogen.

From these analyses we learn the nutrient powers of substances taken as food; and from them we conclude:

1st. That in cold weather fat is not only a proper but a necessary article of food, more especially in a country life, and to out-door laborers.

2d. That lean meat and vegetables, having a much inferior heat-sustaining power, are preferable for persons living in close, confined apartments, warmed by furnaces and lighted with gas.

3d. That a fat diet should be discontinued on the return of summer, or on going to a warm climate; when all decidedly carbonaceous food and drinks should be avoided.

4th. That after an examination of the food necessary to enable the system to meet increasing cold, we are the better prepared to understand what may be necessary to prepare the system to meet the required increase of heat.

When the temperature daily increases or decreases, so that the system is more and more taxed to maintain its exact equilibrium, additional material will be required, of one kind or other, as the case may be, to sustain the new expenditure of vital force. In autumn, there is a special supply of carbonaceous material and a corresponding appetite. In spring, we look for diverse indications in both external nature and ourselves. The first invites carbonaceous food of heating properties, while the last demands food of a cooling nature.

The productions of spring and summer are salads, fruits, vegetables, and the cereals. The two latter

classes ripen late, so as to bring their consumption in the cool rather than in the warm season of our temperate zone. In the tropics, the supply of all four is always adequate to the demand ; while here we have in spring and early summer only salads and a limited quantity of fruit. Most of our garden and orchard fruits are composed of nearly the same constituents, namely, a little woody fibre, more or less sugar, and several acids, of which latter the most common are malic, citric, and tartaric. Two or more of these acids are usually found in every fruit, although one preponderates and gives the fruit its peculiar flavor, as the malic in apples and pears, and the citric in currants. At different stages of the growth of fruit those various substances are in different proportions, the woody fibre or cellular usually being the most abundant. It has been previously stated that woody fibre differs but slightly from sugar ; it will not, then, be difficult to comprehend the fact that, by the action of the acid of the fruit, what is cellular at one time may be found to be sugar at another.

Previous to maturity, fruits are formed of a compact cellular tissue which contains the elements of woody fibre, and is filled with a liquid, a gummy substance, in which there is very little sugar and a large quantity of free acid. When ripening, a part of the acid disappears by the action of oxygen under the influence of the sun, the cellular tissue diminishes, and the proportion of sugar increases, insomuch that, instead of hard, woody, acerb fruits, we obtain, if the ripening has been complete, fruits that yield a saccharine juice.—*Turner.*

The chief elements of ripe fruits, therefore, appear to be water, gum, sugar, and acids, of which the only one still requiring our attention is the acid, and this will be further considered in the succeeding chapter.

Fruits are decidedly more nutritious than young vegetable growth, and, if the system has been properly relieved by eating very light diet in the spring, form a more suitable diet in the summer. As heat increases in the spring, the carbonaceous food required to sustain a sufficiency of heat during the winter becomes oppressive, and the appetite fails in its keen zest for such diet. It is, consequently, then that the early growths of spring allure the imagination, from a universal impression that to eat them conduces to good health, and that they are, therefore, seasonable food. And as the mind alone, not the digestive organs, suggests the necessity of eating the usual quantity of food, the light cellular watery vegetable growths of that season furnish the desired supply, without distressing the systems of those who enjoy tolerably good health. In the spring of the year, hale persons usually feel oppressed, and indisposed to activity. Hence, it is an old custom to seek relief by purgatives, and by filling the stomach with nauseous teas made from herbs and roots, which certainly tend to do some good, in so far as they lessen the disposition to partake of nutritious food. Thus the system is afforded an opportunity to relieve itself of the excess of carbon, which would otherwise form fat or bile, and eventually bring on a bilious fever, or some more serious derangement.

From what we have stated, it may be inferred that

it is essentially necessary to the maintenance of good health, that in the spring, as warm weather approaches, we should abstain from eating so great a quantity of carbonaceous food as we had been accustomed to take during the winter; and that during warm weather we should confine ourselves more directly to a vegetable and fruit diet, when the fruit and vegetables can be procured fresh and uncontaminated by the foul gases generated in and emitted from decomposing matter which has accumulated in the markets and shops and renders them actually unwholesome.

CHAPTER III.

INJURIOUS EFFECTS OF UNRIPE FRUITS.

How unripe fruits affect the system—They are most injurious to young children—Means of relief when injury has been sustained.

WE have, heretofore, more than once stated that fruits and vegetables, as obtained in our large cities, invite the special attention of the citizen, from the fact that they are often purchased from dealers as fresh, when, in reality, owing to the manner in which they have been conveyed to market, they are pernicious. We will now offer a few remarks upon the injurious effects produced by eating unripe fruit, more especially in the case of young children; and upon the means that should be adopted to afford relief when such injury is sustained.

Fruits of all kinds are most frequently gathered before they are ripe, as in such case they preserve a good appearance longer than they do when they are allowed to become fully ripe before they are plucked from the trees or vines. All the soft fruits of spring and summer do not, like the autumnal fruits, ripen weeks after they are gathered. The high temperature arrests the tendency to the formation of sugar and neutralizing salts, and a disposition to fermentation ensues, the effect of which is that the fruits, in proportion to their condition, are unwholesome, and frequently produce violent irritation of the bowels. In the ripening of fleshy fruits we must distinguish two operations, namely, that of growth and development, and that of ripening itself. "Fleshy fruits, and several kinds of berries, acquire, while ripening, a much greater proportion of sugar than they contained before maturity, although full grown. Ripe fruits have not an acid taste, because they contain a larger quantity of basis, by which they are saturated, and not because they are disguised by sugar."—*Mulder.*

Now, to make up the deficiency of taste and flavor in berries purchased in cities, and to render them palatable, sugar must be added to cover the acid; but it has no modifying effect, and merely disguises the flavor of the berries, whether they are raw or cooked. Fruits, when fully ripe, are very palatable and healthy, because they have a sufficiency of sugar generated and combined with other qualities, which can not be imitated nor given to unripe fruit. Neither can the unwholesomeness and imparted qualities of the acids be neutralized in the stomach of a delicate person by

the sugar which renders the fruit palatable; but, on the contrary, it forms an acid, and actually increases the proneness to derangement. To correct this effect, a neutralizing dose of supercarbonate of soda or other alkali has to be taken, and thus physic is substituted for wholesome food.

One of the most prolific causes of the fatality of children in our cities arises from their being, when only about a year old, usually supplied liberally with fruit. The very delicate state of the stomach at that age is such that it is as yet only capable of digesting the most bland of food; consequently a more nutritious organized substance should be furnished to support the rapidly increasing development of the body. A moment's thought must convince us that the effect of the acrid acids of unripe fruit upon so delicate an organ as the stomach of an infant must be to produce a most painful and serious derangement of the whole digestive apparatus. This acerb, pungent food is passed to the intestines, where morbid secretions of an exceedingly irritating character are elaborated; and if, after the abnormal condition has been produced, the child is permitted to continue eating unripe fruit for a time, chalk mixtures or soothing-sirups will but seldom afford permanent relief. Those medicines only palliate, by neutralizing the acid and quieting the nervous irritation. They will not restore the wonted normal functions of the organs affected, and, therefore, a tendency to form the irritating secretions will remain, unless great care is taken to give the child a gentle, nourishing diet, and to avoid the use of any kind of food that conduces to acidity, as, for instance, sweet-

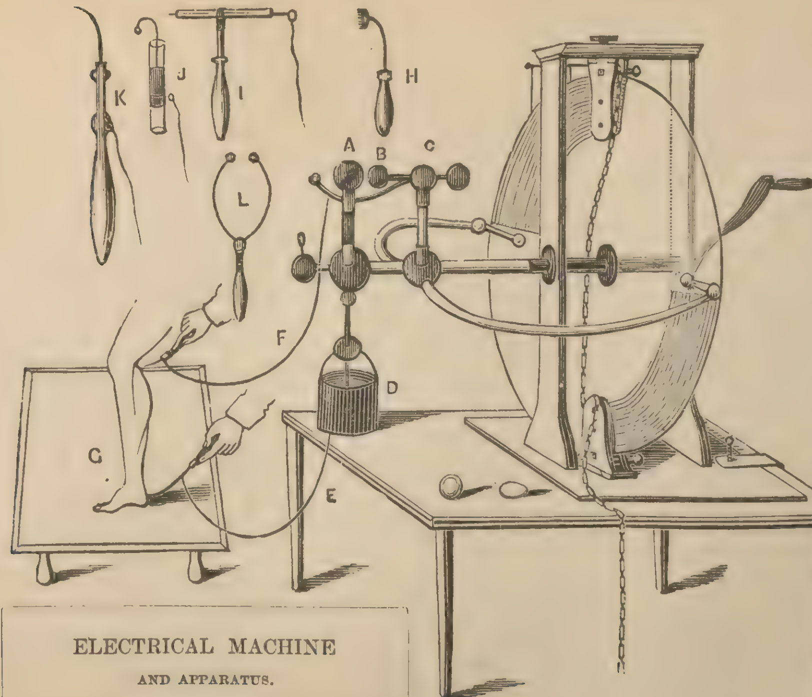
ening in any form. In addition, strenuous efforts should be made to invigorate the system, so that the healthy functions may again be established; and nothing will probably conduce more to the attainment of this desirable object than a bracing atmosphere. At the same time, care must be taken to protect the skin from being chilled, and the blood from being thrown back in excess upon the vital organs. This would distend the larger blood-vessels, and make a serious impression upon the heart, and perhaps cause disease of that organ. Therefore, sudden changes of temperature should be most carefully guarded against, by the wearing of clothing adapted to meet the variations of the weather.

Many of the ailments of children may be attributed to eating acrid, irritating food, owing to its producing derangement of the nervous system, which often terminates in partial paralysis and deplorable cases of deformity. And here we would draw the attention of parents to the means, by a careful and proper treatment, of preventing deformity under such circumstances.

When these seizures of paralysis take place in young subjects, whatever may be the cause, there exists a tendency to a restoration of power, especially in the larger muscles, which present the first indications of returning activity. And as there is not a corresponding counteracting force in the opposing smaller muscles to produce a balance of action, the limbs are distorted in direct ratio to the increased power of the larger muscles. Let this diversity of action take place, for instance, in the muscles of the calf of the

leg, and the result is an inability to raise the front of the foot when an effort is made to walk; the consequence of which is, that the foot will turn inward or outward, and the patient will eventually walk on the inner or outer ankle. The contraction of the stronger muscles keeps those in front of the leg and foot constantly extended; even the bed-clothes, when the patient is in bed, contribute by their weight to keep the front of the foot extended. From this constant extension and want of action, the body of the muscles is absorbed, the foot is fixed in its abnormal position, and the limbs become emaciated to mere skin and bone. When the limbs have been thus deformed, the most ready cure is made by dividing the tendons of the contracted muscles; after which operation there should be applied a skillfully constructed apparatus made of light steel, and so contrived that by its aid the limbs can be brought gradually to their natural position, and the extended muscles relieved. In a majority of cases the latter will recover their lost tone. Much assistance may also be derived from a judicious use of atmospheric electricity;* but it must

* On the opposite page is given a diagram, in which is represented a machine for obtaining *electricity* from the atmosphere, and the manner of applying it to local parts of the body. The upper balls, marked A and B, do not quite approximate, but have a space between them, which space can be increased or decreased by drawing the rod connecting B and C through the central ball. By increasing the space between A and B, the shock can be intensified to any desired degree. If the Leyden jar (D) and the cord attached to it (E) are removed, and the upper cord (F) kept applied to a person sitting on the table (G), the patient will be surcharged with electricity, the table being insulated by means of glass legs. On



ELECTRICAL MACHINE
AND APPARATUS.

[Page 144.

not be employed while the limbs are contracted, as it would impair the nervous energy remaining in the distended muscles and increase the energy in the contracted ones. A similar effect would be produced by sea-bathing, liniments, etc. It will be admitted that prevention is better than cure. The timely application of properly constructed apparatus will not only prevent deformity from taking place in cases of paralysis, but it will contribute to the restoration of power, as such apparatus maintains the paralyzed limbs in a normal position, and enables the patient to make exertions to move. Motion, when made by the efforts of the patient, contributes largely to the cure; but passive motion, on being applied, fails to secure the determined efforts of the will, and, consequently, is not as reliable as that motion which emanates from the patient's own exertions.

the upper left hand corner of the page will be found representations of several instruments used in the application of electricity: H has a handle and a curved metallic stem, with a circular metallic brush attached to the end, and is for the purpose of drawing off electricity from a part where it is necessary to relieve pain or inflammation; I has a handle supporting a glass tube with a wire passing through it, and is used for applying electricity to internal parts; J is a glass tube prepared as a Leyden jar, and gives a much softer shock than the jar, when applied to the machine in its stead; K has a handle and curved metallic stem, and is intended for drawing off electricity, either silently or in sparks, the latter mode being very stimulating when the electricity is drawn off in rapid succession from a very limited portion of the body; L is called a discharger, and has a handle surmounted by two curved metallic stems with metallic balls at their ends, which balls can be sufficiently separated to admit of one being applied to the body of the Leyden jar and the other to the ball at its top, and thereby any electricity that the jar may contain is discharged.

CHAPTER IV.

PERNICIOUS EFFECTS OF STALE MEAT AND VEGETABLES—NUTRIMENT OBTAINED FROM FISH AND FLESH-MEAT.

Stale meat and vegetables very detrimental to the human system—Analysis of meat—Nutritious qualities of fish investigated and determined by comparative density.

STALE, or partially decomposed, vegetables and meats are alike the source of serious evils to the human system. In stale meats we have not the irritating acids to excite the mucous membrane of the stomach and bowels, but they create a more insidious derangement, which tends to chronic disease, and enfeebles the constitution and predisposes it to scrofula. When vegetables become wilted, there is a concentration of their juices, and a consequent chemical change, which is very perceptible from their loss of palatable flavor, the taste being very different from that of freshly gathered vegetables, such as peas, green corn, and lettuce, and, in a word, the whole catalogue of vegetables supplied by the markets in the spring, summer, and autumn. This fact should induce all persons to make at least an effort to correct the imposition practiced upon them by the venders of stale vegetables; and the best way to accomplish it would be to encourage the gardeners by purchasing from

them, and them alone, the freshly gathered products which they bring daily to our cities. A similar course would be advisable in the purchase of tender fruits.

Decomposing animal substances vary very much in their injurious effects upon the system, and in degree to the efficacy of the digestive powers. If eaten continuously for a time, they will prove seriously destructive from engendering morbid secretions. Fibrous meats, whether salted or not, if tainted, are decidedly detrimental to health. Fish, and shell fish, if in a state of decomposition, which readily takes place and is not always detected, are also injurious. The effect is often immediately felt in the stomach, and the foul matter thrown off, thus relieving the system from a more permanent injury. But if the matter is not ejected, a rash supervenes about the neck and face, and delirium and death sometimes ensue.

Ordinary meats or flesh have a very great uniformity in their composition, which consists of fibrin, albumen, and fat. The relative proportions are as follow:

Ordinary lean beef:	Fibrin,	17·70
	Albumen,	2·2
	Salts,	1·13
	Water,	77·17
	Acids and other matters,	1·8
		in 100 parts.

Into the nutritive qualities of fish, as compared with other animal flesh, there has been but a very limited investigation. The flesh of fish is not so highly colored as that of some quadrupeds used as food for man; hence it does not contain so much iron as beef or mutton, but, like pork, it contains much oil.

Fish predisposes to disease of the skin, and, if fried brown, is very indigestible, owing to the formation of a chemical product of a most acrid nature. Boiled fresh fish is comparatively light and easy of digestion. Salt fish is also light and easily digested, if it does not contain much oil and is finely comminuted. When fish that contain much oil, as shad, herring, and mackerel, are salted, the oil absorbs oxygen, and peculiar acrid acids are formed that seriously affect delicate stomachs. The oil of fresh fish is easily digested, and to a considerable amount, even by very delicate persons. Consumptive patients take a table-spoonful morning, noon, and night with most beneficial effects. Cod-liver oil is given to very delicate children, and generally agrees with their stomachs.

The comparative density of the flesh of some of our common fish with that of other flesh has been investigated by Dr. JOHN DAVY, who reported the results to the Royal Society, Edinburgh. The task was undertaken under the supposition that density indicated the nutritive quality of muscular fibre, and elicited the following facts:

	Specific Gravity.	Per cent of Solid Matter.		Specific Gravity.	Per cent of Solid Matter.
Haddock	1056	20.2	Mackerel	1093	37.9
Hake	1054	17.4	Salmon	1071	29.4
Pollock	1060	19.3	Trout	1053 to 1063	22.5
Whiting	1062	21.5	Smelt	1060	19.3
Cod-fish	1059	19.2	Eel	1034	33.6
Beef, Sirloin	1078	26.9	Pork, loin	1080	30.5
Veal, loin	1076	27.2	Com'n Fowl, br'st	1075	27.2
Mutton, leg	1069	26.5	Gray Plover, "	1072	30.1

"These results," says Dr. DAVY, "I wish to have considered merely as approximate ones."

Here it will be observed that the salmon, mackerel, and eel, contain more nutrition or solid matter than beef; and that the specific gravity of salmon is greater than that of mutton. This is worthy of notice, as indicative of a nutritive quality.

CHAPTER V.

THE MOST NUTRITIOUS FOOD OF MAN, AND THE BEST WAYS OF PREPARING IT.

The several modes of cooking meat—Its nutritious qualities, and the methods by which it is rendered most digestible—How to prepare meats for invalids—Milk and eggs: their nutritious qualities—The composition of milk.

FLESH meat is the richest in nitrogenized material, as we shall hereafter very fully describe in this work. This fact will, however, now be referred to in relation to the preparation of food.

No food with which we are acquainted varies so much in its quality, from the various modes of cooking, as meat. Properly broiling is supposed to be the best mode of cooking it, as by that process most of the juice is retained. In boiling, if soup is to be made, the meat should be put into cold water and gradually heated. But when it is merely desired to boil the meat, it should be placed in a small portion of boiling salt water, in which it must be cooked, as then we retain the nutriment in the meat by coagulating the albumen. All salted meats have the albumen coagu-

lated, and therefore are not so easily digested as fresh meats when properly cooked.

The elemental substance known as nitrogen is found abundantly in vegetables; but it is only recently that chemists have determined the fact of the similarity of vegetable nitrogenous compounds to animal fibre or flesh. The various substances containing nitrogen are all modifications of a principle, called by its discoverer, MULDER, *protein*, a word derived from the Greek, and meaning literally, "I am first." It has the following compositions:

Nitrogen,	5.
Oxygen,	12.
Hydrogen,	31.
Carbon,	40.

This substance is the basis of the three principles called albumen, fibrin, and casein, which we have frequently alluded to in describing both vegetable and animal compounds. Meat-flesh of all kinds, whether cooked or raw, contains the largest possible amount of protein, and affords the most nourishment, in a given quantity. Therefore protein may be considered as the nutritious principle in food; and meat-flesh must be placed at the head of the list of food for man. It is well known that that flesh has been the main reliance of man, as food, in his most primitive state. The savage lives almost exclusively on animal flesh, the greater portion being dried and salted, in which condition it is not very soluble but affords the greatest amount of nutriment.

The best methods of preparing flesh-meat for the

diet of invalids are the following: Lean meat from a full-grown, healthy young animal, soaked in cold water, (but not cooked,) yields the most nourishment in a given quantity, and is the most digestible form in which meat can be prepared. The next best mode of preparation is to fill a bottle with similar meat—beef probably being the best. No water must be added. Cork the bottle, and then place it in a kettle of water, and let boil until the meat is cooked. The second is a more palatable preparation than the first, and is not so disgusting to a patient. But as in the second the juices are all retained in a concentrated form, discretion must be exercised as to the quantity to be given and the condition of the patient's digestive powers. The quantity of either preparation should be prescribed by a skillful physician, more especially as such very nutritious diet is only required in extreme cases of debility.

Milk and eggs stand next in the scale of nutritious diet. Milk is perhaps one of the most natural articles of food, and comes nearer fulfilling all the conditions of a perfect diet than any other single substance. It is the food of the young of the most important class in the animal kingdom, (the mammalia,) for some period of its early life. It also enters largely into the diet of man. The composition of milk is by no means uniform, but in different animals varies greatly in the proportion of its constituents. It contains representatives of all classes of food. Taking the milk of the cow for an example, we find in it about 3 per cent of sugar, (carbon 12, hydrogen 12, oxygen 12,) which is a representative of *carbohydrate* compounds,

as starch and sugar, that have hydrogen and oxygen in proportions to form water. We also find about 4 per cent of butter, composed of several fatty bodies belonging to the second class, or *hydrocarbonous*, components, as oils, fats, alcohol, etc., that contain hydrogen in excess over oxygen. Casein, an albuminous compound of the third class, is found to the amount of 5 per cent. Of salts there is about 2 per cent, varying to even less than 1 per cent. In this material, then, we have all the elements of nutrition.

CHAPTER VI.

MILK AND BUTTER: THEIR PROPERTIES AND PRESERVATION.

The properties of milk under various circumstances—Milk well adapted to nourish the young, but not sufficient food for adults—Human milk compared with that of various animals—Cream as a diet—Butter and its component parts—Cheese only fit food for hearty laborers—Means of preserving milk, and the several methods of doing so—Various modes of preserving butter.

MILK is a white, opaque liquid, with a slight odor and sweet taste. Its density is greater than that of water, being 1.036. Fresh milk is always alkaline from the presence of soda. By leaving it standing for some time, it separates slowly and imperfectly into two portions. The superior portion is the cream, which is of a yellowish-white color, unctuous, and pleasant to the taste. The lower portion is of a

bluish white color: it is called *serum*, and is a little more dense than the cream. Both portions are so nearly of the same specific gravity that they scarcely ever perfectly separate, more or less cream being contained in skimmed milk or serum.

By long standing, the milk no longer remains alkaline, but becomes acid. This is lactic acid, which is produced by the breaking up of the sugar. Sugar is, carbon 12, hydrogen 12, oxygen 12; this is simply divided, making two atoms of lactic acid, (being, carbon 6, hydrogen 6, and oxygen 6.) This lactic acid unites with the soda and neutralizes it, when the casein which was combined with the soda is set free and coagulates, and thus forms what is called *clabbered* milk. The action of the air on the casein changes it; and a ferment being thus produced, the decomposition of the sugar takes place. If the air is excluded, these changes will operate very slowly.

The cream is made up of innumerable small spherical cells, $\frac{1}{3000}$ to $\frac{1}{13000}$ of an inch in diameter. They consist of butter inclosed in an envelope. When this envelope is dissolved by the lactic acid, with the aid of agitation, (churning,) the particles coalesce and form butter in a mass.

Of good cow's milk, the component parts of which are given in the next page, about three gallons will make one pound of butter—ordinary milk will not give so favorable a result.

The salts contained in milk are:

Phosphate of lime,	Chloride of potassium,
Phosphate of magnesia,	Chloride of sodium, and
Phosphate of iron,	Free soda.

Although milk is well adapted to the nourishment of the young, it is not suited to the perfect nutrition of the adult; because it does not afford nitrogenized material enough for the active service of adult life. Those animals whose young are enabled to run about almost as soon as born, yield more casein in their milk than is afforded by those whose young remain helpless for a greater or less length of time.

The following are the component parts of human milk, and of that of each of the animals named:

Milk.	Casein.	Sugar.	Butter.	Water.	Salts.	Total.
Human,	1.80	6.50	3.10	87.98	0.62	100
Goat,	4.55	4.80	3.32	86.80	0.53	100
Cow,	4.48	3.77	4.00	87.02	0.73	100
Sheep,	4.50	5.00	4.20	85.80	0.50	100

This shows above double the quantity of casein and less sugar in the milk of the cow than are found in human milk. Hence the necessity, when young children are fed on cow's milk, of adding an equal bulk of water, and of sweetening it.* These additions make it nearly like a child's natural food; and it is nearer still if the milk used is taken immediately from the cow. The longer the milk stands, if it is not confined from the air, the more injurious it is to the child. To render cow's milk, where it has to be kept for any length of time within forty-eight hours, wholesome food for a babe, it should be kept in a cool place and in a jug stopped air tight; and previous to every repetition of filling the jug, it should be cleansed with boiling water containing a small portion of potash or soda, and then cooled. When the milk is used, *warm*

* Darby's Chemistry, p. 382.

water can be added to it, in order to make it agreeable to the child. The same precautions, with the exception of adding water, are essentially necessary when milk is intended as food for an invalid adult; for, as we have just remarked, a very decided chemical change takes place in milk when it is left exposed to the atmosphere. In such case, its tendency will be to generate an acid in the stomach of persons so predisposed, and thus to produce serious inconvenience, as flatulency and even irritative fever.

Cream, as a diet, is very nutritious and easy of digestion. If eaten fresh, with wheaten bread, it is considered an excellent article of diet, and similar to fresh butter and bread, which is a very wholesome food.

Butter when analyzed consists of six acids. *Butyrin* gives to butter its agreeable odor and flavor. Several of the acids have a volatile tendency, and their evaporation leaves the butter rancid, and imparts to it a disagreeable smell. *Caproic* acid has a sweet and agreeable odor; while *capric* has quite the contrary. The change takes place in butter when it is exposed to the atmosphere, and this is owing to its absorbing oxygen rapidly, like other fats. When butter has become rancid, it is not only offensive, but very injurious to digestion, especially when eaten with hot articles of food, or preparations of sugar, sirups, etc.; for the most acrid acids are thereby generated in the stomachs of enfeebled persons, with a direct tendency to form bilious secretions.

Cheese is nutritious, as it consists of casein in combination with rancid butter, which it contains largely; and it is thus rendered indigestible to weak stomachs.

It is a suitable food only for hearty laboring persons, or those who exercise freely in the open air.

To preserve milk for various purposes, as for use on long voyages at sea and in hospitals and places where fresh milk can not be readily obtained, many methods have been tried but found objectionable. About the year 1849, a discovery was made in France by BRACONNET, GRIMAUD, and others, under which it was attempted, on a large scale, to evaporate milk with sugar, and turn it into sirup or a paste; but the process proved a failure. LIGNAC, of that country, however, succeeded in making what he called his *conserve of milk*, which was exhibited at the French Exhibition in 1849, where it drew the attention of the examining judges, who decreed the silver medal to the exhibitor. LIGNAC'S process is to add to a quart of milk, fresh from the cow, 3¾ oz. of sugar, and then to evaporate it to the consistency of a thick sirup. About 60 per cent of the water passes off in this way. It is evaporated in large flat pans, the depth of the milk not exceeding three quarters of an inch. The pans are warmed by being set in warm water, which is then made hot. During the process of evaporation the milk is constantly stirred with a wooden spoon, to prevent the formation of a scum; and after the evaporation the residuum is filled into cylindrical tin boxes, which are next soldered, and then exposed for thirty minutes to a water bath at a temperature of 45° of Fahrenheit. This temperature is obtained by adding to the water in the bath 6¾ ounces of salt and as much sirup for every quart of milk contained in the cans.

When this conserve of milk is to be used, it is only

necessary to dissolve it in the same quantity of water that it has lost by evaporation. A fluid is thus formed which has all the properties of fresh milk, and which, like it, foams when boiled, and is said to secrete cream when at rest. After a box is opened, the evaporated milk it contains will remain unchanged for at least fourteen days, and even for a longer time, especially if the precaution is taken, after removing the quantity required for use, to replace the surface or skin over what is left.

The latest improvement in condensing milk consists in the employment of the air-pump, by which means the milk is protected from the influence of the atmosphere or excessive heat—a most decided advance upon all other methods of a like nature.

Butter can be preserved from rancidity for months, by means of salt dissolved and kept over it in well-made casks. But salt destroys the agreeable flavor by which fresh butter is distinguished, and by its use there is an actual loss of some of the good qualities that render fresh butter easy of digestion.

To preserve the sweetness and flavor of fresh butter, various experiments have been tried, and the greatest success has been obtained by adding to the salt employed in the process of its manufacture one third or one fourth part of sugar. Butter thus prepared can be kept for a period of eight or twelve days, if packed solidly in small tubs, and the surface covered an inch in depth with water, having about fifty-six grains of sulphate of potash, or about the same quantity of pure vinegar, dissolved in the water. If the butter is to be sent away, place it in a tin

cylinder with the opening soldered up. For common purposes, glass or earthen vessels, kept well closed, are the best and most convenient. When thus packed, butter may be kept for three months, provided it is kept cool, at about 40° Fahrenheit.

CHAPTER VII.

NUTRITIVE QUALITIES OF EGGS.

The peculiarities and properties of eggs and their nutritious qualities—Deleterious effect produced by eating stale eggs.

THE component parts of eggs, the food of the young of those animals that do not secrete milk, are protected within a shell formed of the carbonate of lime. In the process of the growth of birds, previous to their being hatched, air enters through the pores of the shell and unites with the phosphorus contained in the yolk. And thus is formed phosphoric acid, which dissolves a portion of the shell, and renders it easy for the young to burst when they are fully developed.

The *white* of the egg is chiefly albumen in a state of solution—15.5 of albumen in about 80 parts of water, and a little mucus and other matters. It also contains varied quantities of oleate and margarate of soda, sulphur, phosphorus, and nitrogen; and coagulates readily by heat or alcohol. As food for man it is very nutritious, and principally forms animal fibre;

but it is hard to digest when firmly coagulated. The vital centre of the egg—the *yolk*—contains more solid matter than the white. It consists of 15 per cent of albumen and casein, and about 30 per cent of fat in the form of margarin and olin. The yolk when eaten is more readily digested than the white, and affords more carbonaceous or heat-giving material. The coloring matter of the yolk consists of iron. The fat globules are similar to cream. A nitrogenous substance is found in the yolk, which substance consists of small quantities of nitrogen and phosphorus, and is known as *cerebrin.* There is a great similarity between the formation of the salts in the yolk of an egg and those in the blood of animals. In a word, we have in the egg all the compounds of elemental substances that constitute the organized animal body.

Stale eggs are very pernicious as a diet, as they contain sulphur and hydrogenous compounds, and readily form sulphurated hydrogen, which is one of the most poisonous gases known to chemists. When formed in the stomach, it produces the most distressing colic, and the flatulent wind which is consequently expelled is of the most foul sulphurous stench. Every precaution should therefore be taken to avoid eating eggs that have been kept long.

CHAPTER VIII.

THE NATURAL FOOD FOR INFANTS, AND ITS SUBSTITUTE.

The primary growth and development of the babe, and its proper nourishment—Advice to mothers who are unable to suckle their offspring—The milk that should be selected—Regulations to be observed in nursing—Influences that tend to vitiate human milk—Afflictions caused thereby, and their proper treatment—Means to be adopted for the sustenance of infants whose mothers are unable to suckle them.

THE nourishment for the young child is the primary formation of stamina for the adult, and is the natural process by which the organic development and strength of man is promoted. This process is perfect or defective in proportion to the state of the individual's health, and to the food that is partaken of possessing the proper nutriment.

Milk, regarded as the nourishment of the infant, forms an important subject of consideration to every one who takes an interest in the health and well-being of his race. When taken directly from the mother or nurse into the stomach, it is very much more salutary to the child than milk that has been exposed to the atmospheric air; for, upon such exposure, it almost instantaneously changes from its normal condition, like blood that has been drawn and left to stand

for a few moments. It is true that milk does not coagulate in so short a time as blood; yet it is affected by a loss proportionate to its animalized qualities. It is, consequently, not so readily assimilated, and thus, encroaching upon the forces of the system to prepare it for the sustenance of the body, causes a loss of development—a notable physiological fact that ought to be heeded in the selection of food for babes. Whatever is difficult of digestion retards development.

When mothers are unable to suckle their infants or to procure a suitable nurse, new milk should be selected that most nearly agrees with human milk in constituents. To assist in making the selection, we refer to page 154 for a table of the comparative constituents of the milk of animals that have been recommended. And, though, as we have already remarked, a child may thrive and do well by being fed upon good fresh cow's milk, diluted and sweetened, still the inquiry is often made, What milk approaches nearest to human milk, or can be best substituted for it? This is readily answered by the table in question. In the consideration of the analyses it contains, it is necessary that attention should be paid, first to the quantity of casein which each description of milk contains—as casein is essential to the development of muscle and vigor—and then to the relative quantities of sugar, butter, and water; as the proportions of all these constituents require to be regulated in the preparation of a diet, so as to render it suitable to the actual physical condition of an infant, to a delicate, robust, or ordinary condition of health.

The milk of the mare and that of the ass approach

nearer the human milk than any of those we have compared, but they are not used in this country. Cow's milk diluted and sweetened is very suitable for a healthy child; but, for one that is much emaciated and feeble, the milk of the goat is preferable, as it contains so much more casein or muscle-making material. However, goat's milk must at first be diluted with two-third parts of water, and the quantity of water must be lessened as the child increases in strength. In order to avoid acidity, which is easily produced in a weak stomach, the sweetening of milk may be dispensed with. This treatment is considered suitable for children until they are six months old, when they may be permitted to take more nutriment; but the increase should be gradual, especially if a tendency to scrofula is observable.

When mothers can nurse their children, they should never deviate from the stated periods for nursing, as such deviation is not only decidedly injurious to the child, by depriving it of its necessary nutriment—a well-determined fact—but it also leads to the annoyance of having it continually fretting for the breast.

In milking a cow, that portion of the milk, to the amount of one third, which comes first, will give much whey and very little butter; the second portion will give less whey and more butter; and the last, a decidedly greater quantity of butter and curd, or casein, than either of the others. As the same results take place in human milk, the fact suggests considerations of importance with respect to the suckling of infants.

By this fact it is obvious that if a mother is in the habit of giving the breast at all times when her child

is restless, she will not only encourage its disposition to fret, but will deprive it of the nutriment it ought to receive. Children treated thus never nurse a sufficient length of time to obtain the nutritious part of the milk, and the consequence is, that they only get the watery portion. Delicate children, who are the most indulged in this very bad habit, are most frequently kept feeble for the want of proper nutriment; and thus it is that goat's milk has been resorted to for such children, with decided advantages in some instances, but with injury in others, owing to their not being able to digest it properly. There are innumerable instances in which it would have been unnecessary to have resorted to goat's milk, provided proper regulations had been observed in giving the breast-milk; for then the children would have derived fully as much benefit from the latter alone as they gained from the former; while in those having weak digestive powers it would have been far more beneficial to them if they had only taken the natural aliment. All that was wanting was the exercise, by the mothers, of a little judgment in the allowance of a sufficiency of time for the food to digest, with other considerations.

The constant eating of palatable, and, most commonly, indigestible food, is one of the principal causes of ailment in adults who complain of feebleness and want of appetite for more substantial diet. They are in a similar condition to that of the feeble babe who is indulged with the breast too frequently, with the exception that the child has the advantage of one of nature's provisions—the power to throw off the exces-

sive quantity, and thus be saved from injury. But when children are thus over-indulged, they not unfrequently throw off nearly the whole contents of the stomach, and the consequence is, that little is left to digest. They thereby become enfeebled and exhibit a tendency to an irritable condition of the glandular tissues and an enlargement of the abdomen, the development of which causes them to cease throwing off from the stomach. An irritable condition of the bowels next takes place, and as the children grow older they have an insatiable thirst. It is then that they are said to be scrofulous, which derangement would have been avoided had they been subjected to proper treatment at an earlier age. The course to be pursued in such a case is plainly indicated—a bracing atmosphere; warm clothing, but not in excess so as to produce much perspiration; a bland, nutritious diet, given at regular stated periods and in moderate quantity; and the usual quantity of fluid required by the child for drink daily diminished to a reasonable amount for a child in good health. If this course fails, after a fair trial, call in a physician. In a majority of cases, however, it will be unnecessary to do so, as, by the foregoing treatment, a restoration of good health will be brought about, if the child is not much over a year old. When much older, children are not so easily relieved.

From this practical information, mothers and nurses are made conscious of the great necessity there exists for observing the means by which a child can be rescued from an enfeebled constitution. Due attention thereto is an imperative duty that devolves upon them, and any failure to perform it may be a source of re-

gret in after life; for they may have to reproach themselves with the reflection that through their negligence much suffering has been entailed upon their offspring or charge—a fearful responsibility, not to man alone, but to a Higher Power that will hold them accountable for their heedlessness.

The same regularity should be observed in suckling a child at certain hours as would be attended to by a well regulated family in partaking of meals, except that the child requires nursing more frequently when very young. By the observance of such regularity the infant will generally empty the breast, and thus obtain the greatest amount of nutriment. Mothers enjoying good health, and attending to this rule, will seldom secrete more than a sufficiency of milk for a healthy child, which alone will afford ample nutriment till it is six months old. When arrived at that age, a child may be permitted once a day to suck a piece of rare lean beef, with a little salt upon it, which will have the effect of gradually strengthening the stomach. In a month or two more it may take a small portion of beef or mutton, and bread and milk as a general diet. When a year old, it should be weaned. Great care must, however, be taken to give the food also at stated periods, as the habit will induce regularity of the digestive process, which is one of the most salutary conditions of health, and the primary force in establishing a good state of health, other things being equal.

The milk of woman, under varied circumstances, differs materially in quantity and quality, and claims special attention, in order that unfavorable circum-

stances may be avoided or guarded against. Care should therefore be taken to avoid fasting too long and partaking of inefficient food, as, for example, much bread, tea, or coffee, with little sugar and milk; and to guard against drinking much of inferior fermented liquors, especially when meat is not eaten, and intemperance in the use of vinous or alcoholic drinks. The milk of mothers and nurses who neglect these precautions contains much carbonaceous and watery secretion, and a very small portion of nitrogenous nutriment to form muscular fibre and substance for the formation of bone. Consequently, children suckled from such a source are generally very fat* when quite young; but after the fourth or sixth month they lose part of this fat, and one or more of the following derangements ensue:—glandular enlargement about the neck; fullness of the abdomen, attended with hardness; morbid and frequent evacuations; pains in the ears and discharges from them; acrid watery secretions from excoriation behind the ears; insatiable thirst; and tardiness in teething or walking. Then follow enlargement of the bones at the joints; bow-legs; knock-knees; a small projection, like the knuckle, in the spine or backbone, which, if not cared for, results in hump-back; pain in one or other of the knees, attended with enlargement of the hip, which, if not properly

* We here make the distinction between fat and flesh for an obvious reason—that it is not flesh or muscle which is formed under the circumstances alluded to, but merely fat. Such a condition is now considered an abnormal one, and not essential to the growth of the animal body.

treated at this stage of the disease, results in hip disease; an enfeebled condition of the digestive powers, etc. Here we have a catalogue of scrofulous indications; but, thanks to a kind Providence, who is ever mindful of erring man, we are permitted to exercise our judgment and skill in the cure of these fearful afflictions, and are blessed with success. Many children thus afflicted are curable; and this fact we wish to impress upon the minds of parents who have been induced to believe that scrofulous affections are incurable, because of their being hereditary. This fallacious idea has arisen from the failure of medicines alone to effect a cure while the most unfavorable circumstances have been permitted to exist; and frequently from neglect to comply with the advice of the most skillful physicians, whom parents and nurses will often deceive by mistaken indulgences to the child, and by assuming to themselves the responsibility of determining what is injurious or inoffensive in the treatment of the case. Those persons who tamper with the health of their offspring or charge, and thus permit it to suffer through life, when it could have been cured, are guilty of an offense that in its culpableness almost amounts to a crime.

Mothers and nurses who have at their command nutritious diet and other comforts of life, often labor under a very unfavorable condition of health for the suckling of a babe. Some are afflicted with indigestion or an acid stomach, caused by the food which they eat not being properly masticated, owing to their teeth being defective; others indulge in eating very indigestible food, which weakens their digestive pow-

ers; while there is yet another class who injure their organic functions by the lazy habit of lying too many hours in bed, or by being too much confined in a close room. These are common causes which produce unhealthy children. When mothers are afflicted with the ailments here described, either a good healthy nurse should be procured, or the child should be taken from the breast and judiciously fed.

Extraordinary conditions of the mind—as grief, fear, anger, and sudden surprise—also produce a very marked effect upon the milk of nursing women. Sudden emotions have been known to suspend the secretion of milk entirely; and anger often changes its quality so as to make it injurious to the health of the child; for, in some cases, it will produce griping pains, and, not unfrequently, most distressing nervous agitation, which sometimes results in convulsions and death. The milk of nurses who are subject to nervous seizures, as hysterics, has been known, during a paroxysm, to become transparent and albuminous, and to rope like the white of an egg, and, in a few hours after the paroxysm has passed off, to gradually regain its ordinary character.

Among other influences which tend to impair the milk of mothers and nurses, we may mention indolence, all undue indulgences, irregularities in taking meals, and staying up late at night, more especially if attended with extraordinary excitement. All these vitiate the milk in proportion to the extent of the indulgence.

From what has been stated, the following conclusions may be deduced: That the maternal milk is the

proper food for infants. That mothers, except from the most urgent and unavoidable circumstances, ought to suckle their offspring, and thus avoid the risk of obscure unfavorable conditions of nurses, by which every precaution may be frustrated and the child injured for life. That the new milk from the mother constitutes the best nourishment, and that the effect of it obviates the necessity of resorting to the bad practice of giving molasses and water, or other physic, to an infant just born, or a few hours after birth, when the child should be applied to the mother's breast, which is most in conformity with nature's laws in providing for the young. That mothers, while suckling their children, should maintain an equanimity of mind, should avail themselves of proper exercise, pursue regular habits, eat wholesome food, breathe salubrious air, and should guard against all undue excitement or depressing influences of mind. That they should also conscientiously observe regularity as to stated periods of suckling, and should have the breast emptied at each nursing; and that, when an excessive quantity of milk is secreted at first, they should draw off a portion before applying the child. That next in suitableness to the mother is a healthy nurse, whose child is of the same age (or as near as can be) as that of the child to be nursed, which nurse should be kept in the house; but if such a person can not be procured, the next resource is cow's milk, as fresh as it can be obtained, (but never kept more than twelve hours,) in which event good rich milk should be diluted with one half warm water, and sweetened moderately with sugar. That milk obtained from a healthy, well-fed

animal is, after that of the mother or nurse, the only reliable food for a babe, as it contains all that is requisite to form the animal body, and to sustain the organism in the healthy performance of its normal functions.

CHAPTER IX.

THE PRODUCTION OF FAT, ITS CAUSES AND CONSEQUENCES.

The nature and tendency of vegetable food—The production of fat is the result of a deficiency of oxygen in the system—Diabetes and its treatment—Its injurious effects.

VEGETABLES enter largely into the food of man, and have a very decided tendency to produce fat. Professor LIEBIG states, that whether fat be formed by the decomposition of fibrin and albumen, the chief constituents of the blood, or by that of starch, sugar, or gum, (vegetable products,) such decomposition must be accompanied by the separation of oxygen from the elements of these compounds. But that the oxygen is not given out in a free state, because it meets in the general organism with substances that possess the property of entering into combination with it. In fact, it is given out in the same forms as oxygen which is absorbed from the atmosphere by the skin and lungs. Hence it may be inferred that a portion of these carbonaceous substances are essential to the sustenance and increase of the body, but an excess of them overburdens. Upon

this subject LIEBIG says: "The abnormal condition which causes the deposits of fat in the animal body depends, (as was formerly stated,) on a disproportion between the quantity of carbon in the food and that of oxygen absorbed by the skin and lungs. In the normal condition the quantity of carbon given out is exactly equal to that which is taken in the food, and the body acquires no increase of weight from the accumulation of substances containing much carbon and no nitrogen. If we increase the supply of highly carbonized food, then the normal state can only be preserved on condition that, by exercise and labor, or by the oxygen obtained from exposure to a cold atmosphere, the weight of the body is increased, and the supply of oxygen augmented in the same proportion."

He further remarks: "The production of fat is always a consequence of a deficient supply of oxygen, for oxygen is absolutely indispensable for dissipation of the excess of carbon in the food. This excess of carbon, deposited in the form of fat, is never seen in the Bedouin or in the Arab of the desert, who exhibits with pride to the traveler his lean, muscular, sinewy limbs, altogether free from fat. But in prisons and jails it appears as a puffiness in the inmates, fed, as they are, on a poor, scanty diet. It appears in sedentary females of oriental countries; and, finally, it is produced under the well-known conditions of the fattening of domestic animals.

"In every period of animal life, when there occurs a disproportion between the carbon of the food and the inspired oxygen, the latter being deficient, fat must be formed. Oxygen separates from existing compounds,

and this oxygen is given out as carbonic acid and water. Heat being generated in the formation, these two products contribute to keep up the temperature of the body. Every pound of carbon which obtains the oxygen necessary to convert it into carbonic acid from substances which thereby pass into fat, must disengage as much heat as would raise the temperature of 200 pounds of water by 70°—that is, from 32° to 102°."

From this well-authenticated statement we learn the result of eating an excess of carbonaceous food—the formation of fat. This is one of nature's preservative means when we are so situated as to be deprived of a sufficiency of atmospheric oxygen and exercise to maintain an equilibrium of healthy action in the system. We must remember that an insufficiency of oxygen predisposes to the formation of fat, and that when fat is not formed, (as it is well known that in many instances it is not,) the free carbonized matter remains in the system, where it tends to create bile, or, as we have stated before, is deposited in all parts of the system in the form of tubercles. Even sugar is formed, and thence arises the disease known as *diabetes*—a fearful malady, seldom cured, and quite as fatal as consumption. All vegetable food containing starch—and it is found in great quantity in nearly all vegetables—is readily changed into sugar when a disposition to diabetes is once established in the system. In such cases medicines afford but little relief, unless the patients are removed to a location where they can enjoy a bracing atmosphere, and are confined exclusively to an animal diet, with their exercise

(and exercise is very necessary) graduated to what they can endure without much fatigue. Exercise facilitates motion and activity in the organism, and creates an increased demand for oxygen, which will be readily supplied from the condensed or cool atmosphere well charged with electricity. Stimulus will thus be given to the nervous system, which stimulus is very conducive to the relief of the sufferers, who are invariably much depressed in spirits, which very despondency increases the ailment by enfeebling the system.

CHAPTER X.

STARCH AND SUGAR AS ARTICLES OF DIET.

Starch is a most abundant product of the vegetable kingdom—The various plants from which starch is manufactured—Change of starch into sugar—Plants from which sugar is obtained—Amount annually produced—Constituents of various kinds of sugar—Process of malting—Pure sugar not a nutritious diet.

NEXT to wood, *starch* is the most abundant product of the vegetable kingdom. It is found in all the grains and grasses, in tubers and bulbs, in the stems of many plants, and in the barks of various trees. It is contained in the cells of the plant, sometimes filling the cells, at other times lying loose in them. Although to the naked eye starch seems to be an impalpable powder, yet, under the microscope, it is seen to be made up of regularly organized grains that re-

semble exceedingly minute seeds, and vary in size from $\frac{1}{600}$ to $\frac{1}{60}$ of a line in diameter, the largest of which are found in the potato, where they are formed in concentrated layers. These grains are unaffected by cold water, but in hot water they increase thirty-fold and form a transparent mass by solution. Dry heat breaks them up into star-shaped particles and renders them soluble. The substance thus formed from flour is called *British gum*, and is used extensively in manufactories, in the printing of calico, and for sizing. Starch forms a large part of the vegetable food that we eat: wheat flour contains from 70 to 80 per cent; corn-meal, at least 80; rice, 80 to 90; peas, 32; potatoes, 20 to 30; and beans, 30. The object of cooking these materials for man or beast is for the purpose of making the starch soluble, and therefore more easy of digestion. It is well known that animals will fatten much faster on cooked than on raw food.—*Darby's Chemistry*.

Arrow-root is from the root of the *Maranta arundinacea*, a West-Indian plant, which is now cultivated extensively in Florida and southern Georgia. When pure, starch should be perfectly free from odor or taste. The Bermuda arrow-root is the best. It makes a stiff, strong jelly, is employed in making *blanc mange*, and in the production of various compositions in the culinary art, and, if prepared with milk, forms an agreeable light diet.

Tapioca is from the root of those very poisonous plants of South-America, the *Jatropha janipha* and the *Jatropha manihot*. The root is ground or bruised, and then pressed in coarse bags, which are suspended

so that they may be twisted to compress the contents, when a milky juice runs therefrom into large vessels, and this juice contains the starch, which soon settles. The starch is then partially baked on hot stones, and by stirring is formed into the irregular grains in which the commodity comes to us. Tapioca is partly soluble, on account of the baking it has undergone. What remains in the bag is called *cassava*, and is used for making a coarse bread. The process of washing and cooking destroys the poison, and renders tapioca one of the most palatable forms of starch. It is made into puddings and gruels, the latter of which are much relished by children—more so, in fact, than any other food. It agrees with the stomach, and if cooked with milk makes a nutritious article of diet.

Sago is from the *sago palm*, the *Sagus Rumphii*, from the Moluccas, and is imported from Singapore. It is found in the shops under three forms, namely, pearl sago, meal sago, and brown sago. Only the first has undergone a process of manufacture; the two latter are merely distinguished by the manner in which they are put up. Sago is used as a mild diet for invalids. One ounce of any of these varieties to a pint of water or milk is sufficient.

Starches will not support life. They make fat, but not flesh, or brains, or nerves. But they are usually cooked with milk and eggs, which supply the materials in which starch is deficient. A child should not be fed long on any of these starchy bodies exclusively. The composition of starch is as follows:

Respirable Elements, or Fat-Making.	Carbon......12.	Nitrogen........ 0.
	Hydrogen....10.	Muscle-Making.. 0.
	Oxygen......10.	

Starch, we repeat, is readily converted into sugar, gum, or fat. In truth, it is discernible to all, that men and animals fed on sugar and starch get fat. LIEBIG has drawn attention to the fact that fat must be produced by a change in the chemical constituents of these substances, by which change they are converted into oil. This deducement was at one time doubted by DUMAS and the French chemists, but recent experiments have led to the confirmation of LIEBIG's conclusions. The fact is one of great practical importance, as it proves that persons may be living on food which will cause them to get fat, but yet will afford no real nourishment for the muscular tissues that require nitrogenous substances.

To convert starch into gum it is necessary to heat it to a temperature of 300°. After that it becomes soluble in cold water, and forms what we have mentioned is called in commerce British gum, which is substituted in the arts for the more expensive gums. If starch is boiled, and, after a small quantity of diluted sulphuric acid is added, boiled again, it is changed into *dextrin*.* By continuing the boiling for several hours, and then neutralizing the acid by chalk, grape sugar is produced. In this process more sugar is obtained than there was starch. Starch is also changed into sugar by freezing, as is indicated by the sweetness of recently thawed potatoes. In ripening fruits, the starch is converted into sugar by the action of the organic acids.

The ready manner in which *sugar* is obtained from

* Maize is now being made, by this process, into molasses, on a limited scale.

vegetable and even animal substances—from the latter for medicinal purposes in small quantities for experiment—but mainly from the vegetable kingdom, would suggest the idea that it ought to be one of the cheapest articles of food, in proportion to the quantity used. This would certainly be the case, were it not for the fact that governments consider it a luxury, tax it accordingly, and rely upon it as one of the great sources of revenue, which it undoubtedly is, as persons in the most indigent circumstances indulge in its use. The demand for sugar is so great that an immense amount of capital has been invested in the culture of the sugar-cane (*saccharum officinarum*) and of the beet, as well as in the manufacture of sugar from those plants. Much capital has also been invested, but not so extensively, in the manufacture of sugar from the maple, palm, sorghum, and imphee, the two latter being now largely brought into cultivation.

Of beet sugar, 362,000,000 pounds are produced annually on the continent of Europe. It is estimated that there are produced annually, throughout the world, 5,154,000,000 pounds of sugar, of which 4,527,000,000 are from the cane, 362,000,000 from the beet, 220,000,000 from the palm, and 45,000,000 from the maple. In the United States there were manufactured in 1860, according to the census tables, 230,982 hogsheads (1000 pounds each) of cane sugar and 40,120,083 pounds of maple sugar; also 14,963,996 gallons of cane molasses, 1,597,589 gallons of maple molasses, and 6,749,123 gallons of sorghum molasses. The imports of sugar into the United States for consumption amount in value to $31,000,000 annually.

Cane sugar consists of

12	equivalents	of	carbon.
11	"	"	hydrogen.
11	"	"	oxygen.

And one hundred parts of juice contain:

Sugar,	18	per cent.
Water and gluten,	71	"
Woody fibre,	10	"
Salts,	1	"

Beet juice contains:

Sugar,	10½	per cent.
Water,	81½	"
Gluten,	3	"
Woody fibre,	5	"

Maple sugar (*Maple sap, Acer saccharinum*) is the same as cane sugar, of which the sap of the tree yields 2½ per cent, the remaining 97½ per cent being almost entirely composed of water.

Grape sugar differs slightly in its composition from that of cane, and is as follows:

12	equivalents	of	carbon.
14	"	"	hydrogen.
14	"	"	oxygen.

The sugar formed in the human system, in the disease called diabetes, has the same composition as grape sugar; so also has the sugar formed from honey, that of all the fruits, and that of starch. Grape sugar is not crystallized like cane sugar, but is similar to that pro-

duced by the decomposition of many plants, as in freezing, etc.

Sugar of milk is composed as follows:

24 equivalents of carbon.
24 " " hydrogen.
24 " " oxygen.

Notwithstanding the apparent difference between this sugar and that of cane and grape, it is considered a true sugar.

The medicinal substances known as manna and liquorice lack the properties of sugar, (although they are sweet,) as they can not be converted into alcohol by fermentation. Rarefied manna, called *mannite*, consists of:

6 equivalents of carbon.
7 " " hydrogen.
6 " " oxygen.

MOLDER suggests that these, or similar formations, are the result of the decomposition of grape sugar in the plants.

Sugar is not so profusely distributed in the vegetable kingdom as starch, but seems to be, in many instances, a result of starch, as in the ripening of fruit and in the germination of plants. A knowledge of the latter led to the process of malting for the purpose of producing sugar, which is essential to the fermentation of beer. No vinous fermentation can take place without the presence of grape sugar; and when cane sugar is added, it changes into grape sugar. Sugar is found in the cerealia and other graminæ, in many roots, as the carrot, turnip, parsnip, and in many other plants.

Starch seems to be the first product in the cells of plants, at certain periods in the growth of which it is changed into sugar, and the sugar again into starch. Many plants contain sweet juices when young, but not when their growth is completed—take, for example, green peas.

Sugar, when taken into the stomach, produces an effect similar to that obtained from starch. When acted upon by oxygen, or, as now expressed, *consumed*, it eliminates animal heat; but when it is not consumed, it is like starch converted into oil and deposited in the tissue in the form of fat. From this result it is supposed to be nutritious.

Pure sugar, however, is not nutritious, for it contains no nitrogen. Life can not be sustained by it, as has been fully determined by MAJENDIE. But much nourishment is obtained by eating of the sugar-cane, as it consists largely of gluten. (See page 178.) Hence it is that negroes fatten and become so vigorous when they eat the sugar-cane and drink its juice during the season in which they gather it. Still, although it contains all the elements required to sustain the growth of the animal body, we would not advise persons with weak digestive powers to attempt to improve their health either by eating the cane or by drinking its juice. If not properly digested in the stomach, it forms various acids, but most frequently lactic acid, which acts as an irritant, and produces serious nervous derangements, at times of a very alarming character.

Under ordinary circumstances, sugar digests much more readily than starch, and, in the form of candies, is generally eaten by children with impunity. This,

however, is not always a safe practice; nevertheless, when sugar is combined with from seventy to ninety per cent of wheat flour, and made plain and light in the form of bread, raised with a little soda, a wholesome diet is produced. The coarser kinds of sugar and molasses are the most nutritious, as they contain more or less of the glutinous impurities of the cane juice.

CHAPTER XI.

THE HISTORY AND MANUFACTURE OF SUGAR.

Sugar was known from the earliest ages—The Venetians brought it into Europe—Its introduction into America—The latest improvements in the manufacture of sugar—Its antiseptic properties—The preparation of fruit jellies.

IT would appear from history that sugar was known in Asia from the earliest ages. About the time of the Crusade, the Venetians brought it into Europe, when it was introduced as a medicine. After the discovery of the Cape of Good Hope, and when that route to the East-Indies was opened to navigation, sugar was made an article of commerce by the Portuguese. The cultivation of the cane was subsequently extended to Arabia, Egypt, Sicily, Spain, and the Canaries; and, upon the discovery of the New World, to America, where it has been pursued with great success, but not without the expenditure of a large amount of capital and many discouraging circum-

stances, which have been gradually overcome by the modern discoveries in chemistry.

The first great discovery was the unfavorable influence of the atmospheric air upon the juice, owing to its action upon the acids producing a very rapid change, and forming, with the nutritious element, uncrystallized compounds. Thus the necessity of immediate evaporation, or of the introduction of some neutralizing material to arrest the action of the acids. For this purpose lime was first used, but it answered only partially, as the action of the air on the nitrogenized materials still produced the very result it was sought to avoid. Sulphate of lime, gypsum, or plaster of Paris, answered much better, as the oxygen of the air united with the sulphur and prevented the changes taking place in the juice. Next, the high degree of heat necessary to produce evaporation of the water was found to be unfavorable to crystallization, and left great quantities of molasses; but further assistance from science also overcame this difficulty. It was discovered that by the use of the air-pump a large proportion of the moist air could be removed from over the evaporating pans, and that one hundred and fifty degrees of heat was sufficient to cause the necessary evaporation required to produce the consistency for crystallization, the result of which was that fifty per cent more sugar could be crystallized than by the old process.

Molasses and coarse brown sugar are the result of the defective process of manufacture. Both contain more or less of the nutritious parts of the cane juice, which are separated from them by various processes of

purifying. Sugar is now purified by passing the sirup through granulated animal charcoal, or burnt bones broken into grains about the size of wheat. One of the former methods was to intermingle some gelatinous material, as bullock's blood, with the sirup, and then boil it; and another, to submit the impure granulated sugar to a process called claying. By the latter the sugar was covered with fine clay, after which was diffused over the clay just sufficient water to simply percolate through it in very small quantity, and to carry off the molasses without dissolving the sugar.

Loaf sugar was originally formed by a process of purifying. The sirup, when properly concentrated and partially clarified, was poured into conical-shaped earthen vessels, with the apex undermost, in order that the fluid and impurities might collect there and be drawn off by the removal of a plug. When perfectly drained it was put up in paper and sold in that shape. It is now purified in large mass and broken up for the convenience of use.

Pure sugar is hard, white, inodorous, and undergoes no change by exposure to air; and, when two pieces are rubbed together, emits a phosphorescent light. It is soluble in an equal weight of cold water, and, to an unlimited extent, in hot water. It is also soluble in about four times its weight of boiling alcohol; but the solution, on cooling, deposits large crystals. These crystals are four or six-sided prisms, beveled at the extremities. Sugar is insoluble in fourth-proof brandy or in any other alcoholic spirits of high proof. Liquors that dissolve sugar contain large quantities of water.

Sugar is one of the greatest antiseptics with which

we are acquainted, as it not only preserves fruits and their juices, but also flesh meat, which it does better than salt. It preserves them by dissolving the albumen and absorbing the water, by which means the fluids are converted into a thick sirup, and the air is thereby excluded.

The success attending the preservation of fruits depends much upon the dryness and purity of the sugar used. The juice of the fruit alone should form the sirup. By the effect of heat part of the juice is changed into sugar, and remains in the form of sirup—a form in which sugar will retain its integrity although diluted with fluid substances equal to its own weight.

When sugar is heated to three hundred and sixty-five degrees, it melts into a viscid, colorless liquid, which, on being suddenly cooled, forms a transparent mass called *barley sugar*. At a higher temperature (about four hundred degrees) it loses two equivalents of water, and is converted into a black porous mass, which has, when cooled, a high lustre like anthracite coal, and is called *caramel*. In the preparation of *fruit jelly*, sugar unites with a substance, found in all kinds of fruit and many vegetables, called *pectine*. When the juice of fruit is boiled, and sugar added, this pectine is converted into *pectic acid*, which is rendered insoluble in water, and forms jelly. But, if boiled for a time after this acid is formed, another acid is obtained called *metapectic acid*, which is soluble in water. In the latter case jelly will not be formed. This is the cause of failure in some attempts to make fruit jellies. The juice of fruit just ripe forms jelly most readily. If over ripe, the process will be

attended with much risk, and is most likely to prove a failure. The hardness of green fruit is mainly produced by pectine and starch filling the cells more or less. As the fruit ripens, this hardness is dissolved by the organic acids changing the starch into sugar, and the fruit is thus rendered delicious.

The test for the two varieties of sugar—grape and cane—is sulphuric acid. If poured on cane sugar, it turns it black, but it will not change the color of grape sugar.

CHAPTER XII.

THE FOUR VARIETIES OF FERMENTATION.

The processes of fermentation and their results—Changes in the germination of seeds and the ripening of fruit—The fermentation of grape sugar and the change of sugar into alcohol—Yeast essential to form vinous fermentation—Formation of acetic acid, or vinegar—Putrefactive fermentation—Heat and cold arrest fermentation—How to preserve meat and vegetables.

SUGAR, starch, gluten, and mucilaginous substances have, under certain conditions, a strong tendency to decomposition. The process is known as *fermentation*, and has been divided into four varieties—saccharine, vinous, acetous, and putrefactive fermentation.

One of the substances known to be subject to *saccharine fermentation* is starch. When gelatinous starch, or *amylon*, is kept in a moist state for a con-

siderable time, a change gradually ensues, and a quantity of sugar, equal to about half the weight of starch employed, is generated. The germination of seeds, as exemplified in the malting of barley, is likewise an instance of saccharine fermentation; as are also the ripening of fruit and the freezing of potatoes and several fruits.

Vinous fermentation is dependent upon the presence of sugar, water, and gluten, which form *yeast*. By it cane sugar is changed to that of grape, the change being essential to the production of vinous fermentation. The temperature necessary to produce this change is from about 70° to 90°, at which heat yeast is formed in a very small portion, and continues as long as any sugar exists in the solution. The change from sugar is to alcohol, in solution with carbonic acid liberated during fermentation—forty-five parts of sugar will yield twenty-three parts of alcohol and twenty-two parts of carbonic acid gas.

Sugar, in solution, is not susceptible of vinous fermentation without yeast; but the juices of fruits and plants do not require it, if exposed to the atmosphere, which is essential to produce fermentation. If juices are heated to 212°, and the air is excluded by corking them tightly in bottles, they may be preserved from change; but a few moments' exposure to the air is sufficient for the absorption of oxygen. *Acetous fermentation* takes place, and finally *acetic acid* (vinegar) is formed.

When a liquor that has undergone vinous fermentation, or even alcohol diluted with water and with yeast added to it, is exposed to the air in a tempera-

ture of 80° or 90°, an intestinal commotion ensues, heat is developed, the fluid becomes turbid, and carbonic acid is disengaged. These changes continue for a time, and then cease spontaneously. The liquor then becomes clear, and is found to be *acetic acid*, (vinegar.) This process is *acetous fermentation.*

Putrefactive fermentation differs materially from the other processes of fermentation, as complete decomposition takes place. Substances known as proximate principles, such as oils, resins, and alcohol, are not liable to this kind of dissolution, and do not undergo putrefactive fermentation. Those substances alone are predisposed to this kind of fermentation that contain hydrogen in proportion to form water, and particularly those which contain nitrogen, with the exception of *caffein*, a substance that will be treated of in a future chapter under the head of *coffee.* Moisture and a temperature of about 80° to 90° is most favorable to putrefaction. A temperature of 32° arrests it and all fermentation completely. Fruits can be preserved from frost, and without injury, at 33° and 34°, a temperature frequently adopted for the preservation of very delicate fruit, such as pears, apples, and peaches.

The gaseous products of putrefactive fermentation are light carburetted hydrogen, carbonic acid, and, when nitrogen is present, ammonia. The residue is vegetable mould, which contains much saline matter.

Heat, like cold, but not as a general rule, exerts a most powerful influence in arresting fermentation. The saccharine juice of the sugar-cane, or of fruit, may have yeast added to it, and fermentation

may have commenced, yet a temperature of 120° will put a stop to the evolution of carbonic acid gas and the formation of alcohol; and in their stead, if this degree of heat is continued, lactic acid, gum, and manna will be produced. Thus it will be observed that alcohol is formed at a low, and lactic acid at a high, degree of temperature in the chemical changes that operate in vegetable juices. The reverse, however, takes place in animal secretions, of which milk furnishes us an example. When the temperature of that liquid ranges from 50° to 75°, lactic acid is formed; but if the temperature is raised to 90°, true vinous fermentation sets in, and alcohol and carbonic acid are the result. It is in this manner that the Tartars prepare an intoxicating liquid from mare's milk.

Again, the influence of a low degree of temperature has a remarkable effect upon the masses of animal and vegetable matter. Whole carcasses will remain unchanged for centuries at 32°, examples of which are found in the bodies of elephants cast upon the shores of the Polar Sea from icebergs, where they must have remained for many thousand years in an undecomposed condition; while, as we have just stated, fruits can be preserved from decay at 33° and 34° without their sustaining injury from being frozen. At 40°, putrefactive fermentation will take place in flesh, and fruit will spoil.

A temperature of 212° will prepare meat, or vegetable substances; and if they are, while at that heat, inclosed in air-tight vessels that will thoroughly exclude the oxygen of the atmosphere, they can be kept in a state of preservation for an indefinite period.

PART V.

Cereals and Legumes.

CHAPTER I.

THE NUTRITIOUS ELEMENTS OF VEGETABLE FOOD.

Vegetables that contain the greatest amount of nutrition—The cerealia stand at the head—From them are obtained gluten, fibrin, albumen, and casein, and all the mineral substances essential to the formation of the animal body—A greater digestive effort required to obtain sustenance from vegetables than from meat—Albumen soluble in water—Fibrin found in the juices and seeds of plants—It is not soluble in water—Is convertible into albumen—Albumen in the egg is changed into fibrin—Leguminosæ produce the greatest amount of casein—Casein abounds in the milk of the mammalia—Oils from vegetables consist of two kinds, volatile and fixed—Why animal oil is more inflammable than starch or sugar—Oil is a suitable diet in extreme cold—Volatile oils produce the various fragrant scents—Fixed oils make a permanent stain—Oils rapidly absorb oxygen.

HAVING in previous pages taken a view of the proximate elements of vegetation and their ultimate analysis, we will now investigate the several varieties of vegetables which constitute the food of man. We commence with those that afford the greatest amount of actual nutriment; these we find to be the *cerealia*, and at the head of that family we place *wheat*, as it contains, next to flesh meat, the greatest amount of protein. All vegetables and vegetable productions, as grain seeds and fruits, contain more or less of the elements that form protein—carbon, hydrogen, oxygen, and nitrogen. As these

have been found in all vegetables, and constitute their greatest bulk, they are denominated the *organic elements*. But with them are also found potash, soda, phosphate of lime, and many other substances, in small proportion, but of the utmost importance in the performance of the several functions of tissues into which they enter. Plants supply the animal body with carbon, oxygen, hydrogen, and nitrogen, in various formations. These constitute the tissues of the vegetable, from which are elaborated and appropriated gluten, fibrin, albumen, and casein, and all the mineral elements required for the perfect formation of the body. But to obtain these essential elements for the formation of the animal organization and for the purpose of sustaining it, a greater bulk has to be eaten of vegetable substance than of animal production. A greater amount of digestive effort is consequently required to procure the necessary nutriment. From this we learn that man will not starve where vegetable food can be found; for he can obtain from it the requisite nutriment to supply growth, strength, and heat—the essentials that sustain life. The albumen, fibrin, casein, and salts will be appropriated to the formation of the solids, soft solids, and fluids; and the starch, sugar, and oil, to the support of silent combustion in the respiratory process carried on in the lungs, in like manner to the consumption of fuel by combustion, when, though there is no flame, heat is eliminated. Heat is continued until the fuel is exhausted, and maintains in the human body, when in a healthy condition, and under all variations of climate, a temperature of 98°, with sixty beats of the pulse and fifteen

respirations in a minute—man being the standard; women and children maintain a higher temperature, have a quicker pulse, and breathe more frequently.

Albumen, whether vegetable or animal, is soluble in water up to boiling, but insoluble after. It contains, in addition to the elements that constitute it, two atoms of sulphur and one of phosphorus. Cauliflowers, turnips, and asparagus contain a large amount of albumen.

Fibrin is found in the juices, fruits, and seeds of plants; and in the blood, lymph, and chyle of animals. It is not soluble in water, alcohol, or ether; and contains but one atom of sulphur and one of phosphorus. It is convertible into albumen, as may be seen in animals fed on flesh, for albumen is found in their blood. Albumen can also be changed into fibrin, as in the white of an egg which furnishes the muscle of the chicken. What was formerly called gluten, and abounds in wheat flour, is identical with fibrin.

Casein is found abundantly in some vegetables and seeds, especially the leguminosæ, as in beans and peas. It also abounds in the milk of all the mammalia, the casein in which is readily formed into cheese. It differs from the last two substances in not containing any phosphorus. It is convertible into albumen, and, though present in milk, is not found in any part of the body. Still it subserves the purposes of the other nitrogenous substances in the sustenance of the animal body. It is distinguished from albumen by not coagulating at a temperature of 167°; also, by its being precipitated from its solution by a small quantity of all weak acids, and re-dissolved by an excess.

Oils obtained from the vegetable kingdom consist of two kinds, known as *volatile* and *fixed* oils. They are present in nearly all plants and seeds. Wheat contains two to three per cent; Indian corn, or maize, nine to twelve per cent; oats, three; rice, one; cocoa-nut, forty-seven; ground-nuts, forty-seven; flaxseed, twenty-two; mustard, thirty-six; and almonds, forty-six per cent. Yolk of eggs also contains nearly twenty-nine; milk, three; and ordinary meat, fourteen per cent. Here again is a similarity of products from vegetable and animal substances.

Animal oil, or oil of fat, consists of:

Carbon, ...	11
Hydrogen, ...	10
Oxygen, ...	1

The large quantity of carbon and hydrogen which it contains renders it far more inflammable than starch or sugar. It is consequently much more suitable than those products for a diet when persons are exposed to extreme cold, as in the arctic regions.

Only the fixed oils constitute the food of man. The volatile oils produce the various fragrant scents and flavors of plants, and leave no stain. A fixed oil makes a permanent grease spot, and when pure has little or no taste or odor. Both are decomposable below red heat. When any of the fat oils are much heated, they give off an exceedingly volatile acrid substance called *acrolein*. This substance is caused by decomposition. It is found more or less in the brown crust of meat that is fried or roasted, and is exceedingly hard to digest. Such fats as lard, butter, tallow, and olive

oil rapidly absorb oxygen from the atmosphere, and form acrid acids, which are decidedly injurious to the digestive powers. Ointments, when exposed to the air, are also rendered acrid and stimulant, and are unfit for use after they have been made any great length of time. Hence ointments should only be prepared for immediate use.

CHAPTER II.

THE RELATIVE NUTRIMENT IN SEEDS EATEN BY MAN— INTRODUCTION OF GRAIN PLANTS.

Relative nutritious qualities of seeds—Grain plants are all annual —Their stems contain silex (flint)—They came from the East— Coffee, tea, and cotton traced from the East toward the West— Traditions in regard to the early cultivation of grain—An American Indian tradition relative to the origin of maize, etc.— Wheat a proof of the civilization of the ancient Egyptians—It is discovered in their sepulchres—Cerealia grown before the time of Noah's flood—Bread made by Abraham's wife—Joseph's dream of the sheaves—Pharaoh's dream of seven ears on one stalk— Humboldt on the migration of plants—Man has selected for his food about twenty of the most abundant seed-bearing grasses— Bread grasses not originally found in Mexico—Wheat introduced into that country by a slave—By whom it was carried into Peru —The first wheat that reached Quito—The Spaniards introduced wheat into America — Spring wheat less hardy than winter wheat—Advantages to be derived from growing spring wheat.

THE following analysis of the constituents and alimental qualities of the cerealia and leguminosæ gives the number of parts in a total of a hundred their several varieties contain of water and ashes, and of nitrogenous and carbonaceous formations :

		Water and ashes.	Nitrogenous formations.	Carbonaceous formations.
Cerealia . . .	Wheat,	7 parts.	23 parts.	70 parts.
	Rye,	10 "	18 "	72 "
	Barley,	17 "	14 "	69 "
	Oats,	20 "	11 "	69 "
	Rice,	11 "	1 "	88 "
	Maize,	12 "	7 "	81 "
Leguminosæ	Peas,	19 "	29 "	52 "
	Beans,	17 "	31 "	52 "
	Lentils,	19 "	33 "	48 "

The grain-plants are all annual, and send up a straw or cullum, which is either hollow or contains pith, and is divided into joints. At these joints the leaves have their insertion, one at each joint, and on alternate sides of the stem. The outer covering of the stem contains silex (flint) in very fine division; it is found in the ashes of burnt stalks, and forms the principal obstacle to the production of paper from straw. The leaves enfold the growing stalk and germinating grain, which, as they increase in growth and arrive at maturity, are liberated by the case falling backward. The ears of grain are placed on a stem, or *rachis*. A variety called Egyptian wheat forms branches of rachis. Oats have naked branches, and the seeds on the end are called *panicles*.

Those plants from whose seeds we obtain our varieties of bread, wherever they are found, indicate the presence of man. He has taken them with him to all the temperate regions of the earth; and, as they were not designed for him alone, graminivorous animals have accompanied him. He started from the East, and, as distant lands became his abiding place, different climates contributed to the number of grasses and animals. The period of the earth's his-

tory at which man made his advent is not positively known; for on this point we have only speculation without fixed data. In modern times coffee, tea, the sugar-cane, cotton, the banana, and some of the spices have been traced from the East toward the West. Man's acquaintance with the cerealia, however, so far precedes the transportation of these luxuries that the history of grain-plants seems to be lost in the vista of time, as is also that of those domestic animals which have accompanied him from his earliest migration. Hence, inferences have established probabilities, and tradition and mythology point to the gods as the first givers of these blessings. The Hindoos believe that Brahma descended rom heaven for the purpose of bestowing them upon his followers, and that he excluded all animal food and forbade any indulgence in it. In Egypt Isis, in Greece Demeter, and in Rome Ceres, have each accorded to them by classical writers some similar act of beneficence. The ancient Peruvians, when discovered by the Spaniards, only cultivated their maize on sacred ground around the Incas' Temple of the Sun, at an elevation of twelve thousand feet above the sea. The grain was first offered as a sacrifice to their god, and was then distributed among the people, who attributed to it miraculous powers.

Dr. Franklin thus relates a traditional story of the American aborigines concerning the origin of maize and other plants, which he heard from an Indian chief of the Susquehanna tribe: "In the beginning, our fathers had only the flesh of animals to subsist on; and if their hunting was unsuccessful they were starving. Two of our young hunters, having

killed a deer, made a fire in the woods to broil some part of it. When they were about to satisfy their hunger, they beheld a beautiful young woman descend from the clouds and seat herself on that hill which you see yonder among the blue mountains. They said to each other: 'It is a spirit that, perhaps, has smelt our broiling venison, and wishes to eat of it. Let us offer some to her.' They presented her with the tongue. She was pleased with the taste of it, and said: 'Your kindness shall be rewarded. Come to this place after thirteen moons, and you shall find something that will be of great benefit in nourishing you and your children to the latest generations.' They did so, and to their great surprise found plants they had never seen before, but which, from that ancient time, have been constantly cultivated among us, to our great advantage. Where her right hand had touched the ground, they found maize; where her left hand had touched it, they found kidney-beans; and where she had seated herself, they found tobacco."*

Wheat is said to have been introduced by the Emperor Chinnang into China, where it is reported to have been cultivated three thousand years before the Christian era.

These various claims to supernatural agencies can only amuse, and leave us to conjecture and draw inferences. That the cereals were cultivated at a very early period is a just inference, and attests man's civilization. One of the proofs of the civilization of

* Memoirs of the Life and Writings of Benjamin Franklin. By his grandson. Page 273.

the ancient Egyptians has been the discovery of wheat in the sepulchres of their kings, which were so perfectly inclosed that the atmospheric influence which would have decomposed the grain was excluded for many thousand years. When discovered by the naturalists in the French army on its invasion of that country, the grains were found to have retained their form and color, and proved to be of a species that had never been discovered growing wild in any part of the world.

That the cerealia was cultivated before the deluge is most probable, as the Bible says that "Adam's sons tilled the ground," and that it was promised to Noah and his people that "seed time and harvest should not cease." It also tells us that four hundred and fifty years after the flood Abraham directed his wife to prepare three measures of fine meal to make cakes upon the hearth for the strangers who visited him. This is the first intimation we have of flour being made from grain, or of bread being made and baked; but we do not infer from it that flour and bread were then first made and baked. One hundred and forty years later it speaks of Joseph's dream of the sheaves, and of Pharaoh's dream, in which he beheld "seven ears of corn" upon one stalk, which Joseph interpreted as representing seven years of plenty that were to come to the land of Egypt, as well as of Joseph having in those years "gathered corn as the sand of the sea."* This agrees with the peculiarities of the wheat found in the Egyptian catacombs, known as *Triticum compositum*. It often produces seven ears on one stalk. Wheat is frequently named in the Bible, as we read in

* Genesis xxxvii. 7 and xli. 5, 49.

it of "the finest of wheat," and of "wheat of Minneth." It would then appear to us not unreasonable to suppose that for man were created the domestic animals, the cerealia, and fruit, as they are all included in the general term "fruits of the earth," which we are told were given to man on his introduction to this planet.

In taking a view of more modern times, we know that *wheat* was taken into Europe by the Romans, the *vine* by the Greeks, and *cotton* by the Arabs upon their incursions into Spain. HUMBOLDT observes that the migration of these plants is evident; but the first country of each is as little known as those of the different races of men, who, from the earliest traditions, have been found in all parts of the globe.*

Wheat (*Triticum vulgare*, WILL.) is the most important and widely distributed of the bread plants, and has been selected from about four thousand grasses. Out of these man has chosen about twenty that are the most abundant seed-bearers and require the least labor to obtain their products, and has appropriated them for food for himself and his domestic animals. As soon as a division of labor was established, the agriculturist gave the surplus over his own wants to commerce, and, finding it profitable, availed himself of the advantages to be obtained by the introduction of his produce into foreign countries.

None of the bread-producing grasses of the East were found by the Europeans when they first visited Mexico. Wheat was first introduced into that country, in the year 1530, by a negro slave belonging to CORTEZ, who found three or four grains among some

* Geographie des Plantes, p. 35.

rice; and though he made a most advantageous use of this great prize to the country, nothing further is known of him. A different story is told of the Spanish lady (MARIA D'ESCOBAR, wife of DIEGO DE CHAVES) who bestowed a similar blessing upon Peru, by taking a few grains of wheat to Lima. Her name, together with the plan she adopted for effecting her object, that of carefully distributing the produce of successive harvests among the farmers, have been carefully noted by the historian. Still the exact date when this event took place is unrecorded, but wheat bread was scarcely known in the city of Cuzco in the year 1547. The first grains of wheat that reached Quito were conveyed thither by Father JOSÉ RIXI, a Fleming, who grew them near the monastery of St. Francis, where the monks still preserve and show, as a precious relic, the rude earthen pot that contained the seeds. History thus informs us that wheat was originally introduced into America by the Spaniards, and it further teaches us that it has since been distributed throughout the whole continent in many varieties.

The cultivation of winter wheat in the Middle States is now very common. Spring wheat (*Triticum æstivum*) is supposed to be a native of Siberia, and is the type of all the varieties called summer and spring wheats. It is less hardy than the winter wheat, and the whole plant has a more delicate appearance. The principal advantage to be derived from the growing of this wheat consists in the security it offers against the injurious effects of cold and wet springs to which winter wheat is liable, and which sometimes so much impair it as to destroy all prospect of a harvest.

In such a crisis, the delicate but more rapidly growing variety of spring wheat may be more confidently relied upon. When, at the close of winter, it is perceived that the seed sown in autumn has completely failed, it is a good custom to replace it with this wheat, or, when there are bare patches, to rake it into the vacant spaces, and thus restore the uniformity of the crop.

CHAPTER III.

WHEAT AND THE MANUFACTURE OF BREAD.

Analysis of the nutritive qualities of wheat—Winter wheat more nutritious than summer—Difference in wheat grown in warm and cold regions—One of the most desirable varieties—The structure of a grain of wheat and its nutritive parts described—Properties of *cerealin*—It is essential to promote digestion—The weight of wheat and average yield of flour—Pernicious effects of fats in flour—They are increased by baking—When bread is most soluble—Ordinary mode of making bread—Injurious effects that may arise—When properly fermented sugar is formed—Skill required to make good bread—How to obtain a proper fermentation—How to make yeast.

ACCORDING to the analysis of Sir HUMPHRY DAVY, the nutritive quality of spring wheat is not quite equal to that of winter wheat, the proportion being only 92½ per cent in the former to 94 in the latter. The gluten or fibrin contained in the two kinds varies in a greater degree—that in winter wheat being 24 per cent, while that in spring is only 19. The winter variety is consequently the most desirable for

the baker. A similar difference exists between wheat grown in our Northern and Eastern States and that raised in the Southern, Middle, and Western States. The greatest amount of starch is contained in the wheat that is produced in the colder regions. Its flour is termed by the baker *short*—hence less nutriment—and is less desirable for bread than that grown in warmer climates, as the loaf can not be made so porous or light, nor so large in size for the weight of flour used. It is, however, very desirable for pastry, as it requires much less butter or fat than the latter to shorten it and make it bake crisp. It thus appears that, to a certain extent, locality determines the nutritive quality of wheat, which is true even of the finest varieties, if grown in localities unsuited to them.

One of the most desirable varieties of wheat known is called the Landomir, which derives its name from a district in Southern Poland; but to grow it equal to the sample obtained therefrom has disappointed the most skillful agriculturists.

"The structure of a grain of wheat from which our flour is made," says Professor DARBY, "is not properly understood, and its nature not properly appreciated. It is an object of the highest interest, since untold millions depend on its production; and were it better understood, and its constitution a matter of more universal knowledge, the interests of society might be greatly advanced. The wheat grain is a fruit, not a seed only. It is a one-seeded fruit, as though we had a one-seeded bean or pea-pod. The only difference is that the pod of the wheat is closely applied to the seed, but in the bean or pea it is not; the seed is

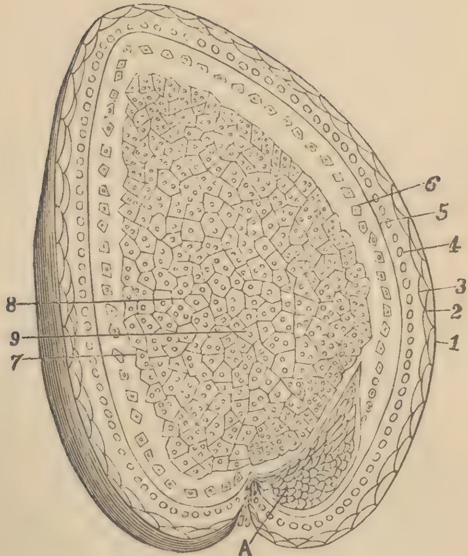
loose in one case, and closely enfolded in the pod in the other. The same is true of corn, oats, rye, etc.

"The accompanying figure is a representation of a section of a grain of wheat from end to end, greatly magnified, so as to show it as it appears under the microscope. The membranes are represented as separated, so as to make them distinct.

"The membranes, marked 1, 2, 3, 4, make up the pod: 1, the *cuticle*, or outer skin; 2, the *epidermis*; 3, the *epicarp*; 4, the *endocarp*. These envelopes have no nutriment in them, are colorless or of a light brown color, and form the toughest part of the bran.

"No. 5 is the outer covering of the seed and gives color to the grain. It belongs to the bran, and takes no part in nutrition.

"No. 6 is an important portion of the seed, andought always to be, but is seldom, in the flour. It is mostly contained in the *shorts*—a name given by the millers to a very fine quality of bran, which is sold as a superior feed for cattle to that of coarse bran, in which there is little or no nutriment, though some will be found in the flour that adheres to it. This portion of the seed is nutritious, and medicinal in one sense, and its chemical relations are of the most important character, not only in alimentation, but in germination, as it protects the embryo from improper influences, and in a great degree controls the agencies that stimulate vitality. It is composed of regular cells, filled with a substance called *cerealin*, which by its action decomposes starch, converting it into a soluble state, and liquefies gluten, or, properly speaking, vegetable fibrin. Dough loses its elasticity by standing, if this substance



SECTION OF A GRAIN OF WHEAT, MAGNIFIED.

1. The *Cuticle*, or outer skin.
2. The *Epidermis.*
3. The *Epicarp.*
4. The *Endocarp.*
5. The outer covering of the seed that gives color to the grain.
6. First layer of the seed, having cells containing *cerealin.*
7. Second layer of the seed, containing starch and gluten.
8. Third layer of the seed, containing starch and gluten.
9. Interior of the seed — nearly pure starch.

A. The Germ.

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is present and the temperature is moderately high. It bears a high temperature without losing its property of liquefying gluten, and it is, consequently, active during cooking or baking. Bread that contains this material liquefies in the stomach and is easily digested; while bread that does not contain it continues pasty, is with difficulty disposed of by the stomach, and causes dyspepsia and many painful symptoms. Animals will die if they are fed on pure white bread, but they will flourish on bread made from the same grain if it contains this membrane. In the one case the cerealin is present, in the other it is wanting.

"No. 7 consists of cells filled with starch and gluten, and is the most nutritive portion of the grain.

"No. 8 is like No. 7, but contains more starch and less gluten.

"No. 9 is nearly pure starch, and is but slightly nutritious.

"Fine flour consists almost entirely of Nos. 8 and 9 and the shorts of Nos. 6 and 7, which are the healthiest and most nutritious parts of the grain. Flour ought to contain 6, 7, 8, and 9 ground together; and whoever will devise a plan by which this can be accomplished will confer a blessing on his fellow-beings. All the nutritious portions of the grain were intended to be eaten by man, but custom gives us the poorest portion at the highest price, under the name of 'superfine flour.'" Flour containing all the bran is injurious from the irritating properties of that indigestible article.

The average weight of a bushel of wheat is about sixty pounds. Inferior samples seldom weigh less

than fifty-six pounds; and the best as seldom exceed sixty-two pounds.

A bushel of wheat of the average weight, on being ground, will yield of flour........... 47 pounds.

fine shorts.......	$4\frac{1}{4}$	"
coarse shorts....	4	"
bran	$2\frac{3}{4}$	"
Loss of weight in grinding and bolting,	2	"
	60	"

As much flour is used in making pastry, cakes, and various dishes, in which lard, butter, and other fats are employed, and most indigestible compounds are thus produced, it may be well to state that such compounds are far more injurious than the eating of buttered baked cakes or warm bread. The browner these compounds are baked, the more pernicious they become, as the fat is thereby decomposed, and *acrolein*, one of the most acrid and indigestible substances formed in cooking, is produced and retained. The injurious effects of eating warm bread arise from its insolubility, and are increased by the use of rancid butter. Bread only becomes soluble after it has become perfectly cool—about twelve hours after baking. By that time the cerealin has rendered the gluten or vegetable fibrin soluble.

The mode of making bread claims special attention. It is ordinarily made by adding to a certain portion of flour, mixed with warm water or milk, some substance that will excite fermentation, (as yeast either alone or infused in a mass of flour prepared for the purpose,) and thereby dough is pro-

duced of proper consistency. This dough is kept warm to facilitate fermentation, for which purpose a uniform temperature of about ninety degrees is required. If the temperature is below seventy degrees, and is continued for a time below that point, an acid is formed; yet the dough will rise and make light bread, but the very best qualities of good bread will be lost; and, although soda may have been added, the saccharine principle will not be restored. In such a case the delicious, fresh, sweet taste of well-made bread will be wanting, and much of its nutritious quality wasted. Such bread will have a decided tendency to generate acid in the stomach, and will possess the same insipid taste as unfermented bread. On the contrary, when the dough is properly fermented, sugar is formed, as in the process of malting; for, although in the one case we use flour, and in the other the whole grain, the process is identical—that is, the chemical action is the same; and this action should be arrested in the dough at a proper time, by putting it into the oven for baking. As, in malting, the germinated grain is heated on the kiln to arrest the chemical process and secure the sugar generated in the grain, so, in baking, there is no loss of the gluten, but only a change of starch and the organic acids to form sugar. The carbonic acid is set free, and the bread is thereby rendered sweet and light. To accomplish this very desirable end, great skill must be exercised, quite as much as is requisite in the preparation of malt. All persons attempting to bake loaf bread should make themselves proficient in the art, instead of "trusting to luck," as is most commonly the case with housekeepers

who pay no regard to careful practice, and who, consequently, seldom make two bakings of bread alike out of the same barrel of flour. It is owing to such very unskillful and careless practice that fermented bread has been disparaged, and new processes have been introduced of puffing up flour and water with carbonic acid gas, which, instead of developing the saccharine matter so very delicious in well-made bread, leaves it insipid to the taste, its only quality being that it does not impair the nutritive property of the flour.

To obtain a proper fermentation, it is necessary to be prepared with a small quantity of yeast. This must be well diffused through the whole mass of dough made with warm water or milk, and kept at a temperature of not less than ninety degrees. The dough, when thus prepared, may, however, be kept some twenty degrees above that point, with decided advantage; for the quicker the fermentation is accomplished the sweeter will be the bread, and the greater the nutriment it will contain. To make yeast, it is generally supposed that hops are essential. Such, however, is not the case. Hops only contribute flavor, and for that purpose they are used in making beer; and as yeast is usually obtained from the brewery, it is thus that the idea has become established that hops are necessary to make yeast. Yeast for culinary purposes, is readily made by a mixture of milk and flour formed into a semi-fluid, at a temperature of not less than ninety degrees, and kept at that warmth till a brisk fermentation is established. It is then fit for use, and suitable for the fermentation of dough or any purpose for which yeast is required.

CHAPTER IV.

RYE: ITS QUALITIES AND USES.

Rye, as a nutrient, stands next to wheat—It was not known in ancient India and Egypt—Pliny mentions its cultivation—Its use south of the Baltic Sea—In Sweden it is made into cakes—How it is grown in Lapland—Fungus growth on rye—Its poisonous qualities—Favorable condition for its growth—Its effects in bread—Serious consequences resulting from it in various countries—Animals and insects poisoned by it—Good qualities of rye—Importance of the rye crop—A good fertilizer—Rye not so readily digested as wheat—Owing to its saccharine qualities, it is most readily malted—Is made into ardent spirits, and is much used as a substitute for coffee.

RYE, (*Secale cereale*)—the bread-seed standing next to wheat in importance as a nutrient for man—was not known in ancient India or Egypt. The Greeks obtained it from Thrace and Macedonia. PLINY mentions its cultivation in Europe and Asia between 50° and 60° north latitude. In America it grows between 40° and 50° north latitude. It constitutes the principal bread eaten by the inhabitants of the sandy districts south of the Baltic Sea and the Gulf of Finland, and not only forms the chief article of consumption among the population of those little better than sandy deserts, but furnishes a sufficiency for an export trade to the Rassian ports.

In Sweden the inhabitants generally subsist upon rye cakes, which are baked only twice a year, and become, during the intervals, as hard as a board. LINNÆUS relates that he observed in Lapland a curious practice, which consists of taking one part of rye and two of barley, and mixing them together, and planting the seeds so mingled as soon as the ground is capable of tillage in the spring. The barley grows vigorously, ripens early, and is reaped; in the mean time the rye, being overshadowed by the barley, merely forms leaves, but after the latter is reaped, it strengthens so as to establish itself for the following year, when it yields an abundant crop.

This very valuable aliment is subject to a disease which renders it not only noxious, but actually poisonous. The diseased growth assumes a peculiar form, and is called horned or spurred rye, and, by the French, *ergot*, from the fancied resemblance to a cock's spur. This morbid growth consists of seemingly solid elongated masses, which spring from the ovary of the rye and other grasses. It is of a firm mealy consistence, with a concrete, scaly, or powdery crust. WILLDENOW, DE CANDOLLE, FRIES, QUEKETT, and Dr. ROBERT LATHAM, have all carefully examined it, and the latter, in a paper read before the British Association for the Advancement of Science, at Cambridge, drew attention to the fact that the attacks of this disease on other grasses besides rye were very frequent, and pointed out the danger of allowing animals to feed on grass so disordered. The disease is supposed to be promoted in growth by wet springs followed by unusually hot summers, which are favorable to the production of

all fungi, the sporules being diffused, and only requiring such spring and summer weather to make their growth.

Tissot, a French physician, has paid much attention to the consequences on the human system of eating spurred rye. Bread made of rye thus diseased has an acrid and nauseous taste, and its use is followed by spasmodic symptoms and gangrenous disorders. These effects can not, by any means, be classed among imaginary evils. In 1596, an epidemic prevailed in Hesse, which was wholly ascribed to the use of horned rye. Many persons who had eaten of the diseased grain made into bread were attacked, and died, whilst others suffered from epilepsy and even insanity, from which they never recovered. Similar calamities also befell the people in various parts of Europe, between the years 1648 and 1736, the particulars of which are recorded by Burghart, Hoffman, and others. In 1709, this diseased condition of the rye occurred in a part of France to such an extent that, in consequence of it, no fewer than five hundred patients were at one time under care of the surgeons of the public hospital at Orleans. The symptoms commenced with all the apparent characteristics of drunkenness, after which the toes became diseased, mortified, and fell off. The disease then extended up the leg, and frequently attacked the body; and this latter sometimes occurred even after the amputation of the diseased limbs.

The poisonous influence of horned rye is not exerted upon human beings alone, for both insects and larger animals have been fatally affected by it. Flies

that merely settled on it have been killed. Deer, swine, and poultry, upon which experiments have been tried with it, have all died miserable deaths, some in strong convulsions, others with mortified ulcers.

The *ergot* of rye, or, as it is termed in our medical works, *Secale cornutum*—in plain English, horned rye—has been admitted into our pharmacopœias as a most valuable medicine in the hands of skillful practitioners, but, like all powerful and useful medicaments, it has been improperly and unskillfully used.

Rye is an important crop, and is usually grown on light soil. It is extensively cultivated and used for bread, especially in our Eastern States; while it makes a cheap and most excellent food for cattle, when mixed and ground with oats and corn. The yield per acre is about seventeen bushels. The total produce of rye in the United States in 1860 was, according to the last census, twenty-one million one hundred and one thousand three hundred and eighty bushels.

It has been found to be a valuable fertilizer, if grown among corn, and hogged down, as it is termed; that is, the grain is eaten by the hogs from the straw, on the field, and then the straw is plowed in. It thus forms a cheap food for hogs, as very little is expended for labor—a valuable consideration, particularly in our Western States, where labor is so scarce.

Rye rates next to wheat in the amount of gluten or vegetable fibrin contained, hence its applicability for fermented bread; but bread made from rye-flour is not so digestible or nutritious as wheaten bread. The grain contains about five parts of gluten to every hundred

of saccharine matter, which renders it suitable for malting or making beer or ardent spirits, of which latter there are about ten million gallons distilled annually in this country. However, the produce of rye is comparatively small to that of barley, and, consequently, it is not so extensively used for those purposes. Rye changes rapidly from the vinous to acetous fermentation, which renders it undesirable for distilling.

It is not suitable for food when there is a tendency to acidity of the stomach, or where the digestive powers are enfeebled.

In the form of a vegetable acid, rye has been much used by tanners in the operation of what they call *raising*, which is rendering the hide porous, so that it will more readily receive the tanning principle from the oak bark.

The grain is also resorted to as a substitute for coffee. When mixed with the coffee-seed and roasted, it absorbs much of the aroma of the latter, which aroma would otherwise be thrown off and lost; and if an excessive quantity of rye is not used, the addition is not easily detected in the finest qualities of the fragrant Mocha—in fact, the beverage produced is actually enriched by the mixture.

CHAPTER V.

BARLEY, MALTING, AND BREWING.

The countries in which barley has been discovered—The several varieties—Cultivated by the Jews in the earliest ages—Grains of it found in the Egyptian catacombs—Egyptian traditions respecting it—Barley is best suited to a northern climate—It is not so nutritious as wheat—A grain the measure of one third of an inch—Barley extensively cultivated for brewing into malt liquors—Fermented liquors made from barley at a very early date—They are still made in Egypt and Nubia—The Anglo-Saxons drank ale and mead—The old ale knights of England—Attachment of the English to ale—The introduction of hops into ale forbidden by Henry VIII.—Large consumption of malt and hops in Great Britain—Mode of manufacturing malt—Process of making malt liquors — Good qualities of pure fermented liquors—German lager-beer affords no nutriment, and is very intoxicating—The lager-beer of the United States is different—Amount of beer manufactured in the United States.

BARLEY, (*Hordeum vulgare*, LINN.,) an ancient writer* informs us, grew abundantly and wild in the regions between the Euphrates and the Tigris. Its native country is placed by WILLDENOW on the banks of the Samara, a tributary of the Volga. C. A. MEYER found the *two-rowed* barley (*H. distichum*) growing wild between Lenkeran and Baku; C. KOCH discovered it on the steppes of Schirwan in

* Voyage en Persie, 460.

the south-east of the Caucasus; and KOTSCHY in South-Persia. The *six-rowed* or winter barley (*H. hexastichon*) has been the longest known. The Egyptians, Jews, and East-Indians cultivated it in the earliest times, and grains of it are found in the mummies of the Egyptian catacombs. The *sprat* or *battledore* barley, (*H. zeocriton*,) sometimes called the rice barley, has shorter and broader ears than either of the above varieties, and seldom grows so tall. It furnishes an excellent meal, and in this respect is distinguished among the varieties. Common barley came to Europe by way of Egypt, where, at the present day, the two and the six-rowed are still cultivated. In ancient Greece both those varieties were grown, but with the modern Greeks the common and six-rowed only are grown, and merely as fodder for horses. The Romans cultivated the two and the six-rowed barley in connection. In Europe, even to beyond the North Polar Circle, and near to it in Asia and America, oats and barley are cultivated.

The Egyptians have a tradition, that of all the grains, barley is the one which was first used as the food of man; and that the art of cultivating it was imparted to their ancestors by the goddess *Isis*, who, having discovered the plant growing wild, instructed men how to cultivate it, so as to increase the quantity and improve the quality of its produce.

We believe, however, that there is as little known about the native country of barley as about that of wheat, next to which, at the present day, it stands among the cereals in respect to the amount cultivated, whilst of cereal products that are manufactured into

stimulant drinks, it occupies the head position. Barley is, under certain circumstances, of even more importance to man than wheat. It can be cultivated over a wider range of climate, under greater extremes of temperature, and in lighter soils than wheat; it is not so seriously affected by drought, and arrives so much earlier at maturity, that it can be grown in the short northern summers without failure. In Spain, two crops can be harvested within the year—one in the spring and the other in autumn. Barley sown there in June can be harvested in three months; and it is stated that in the northern climates the growth is perfected in a still shorter time. LINNÆUS relates, in his Tour through Lulean Lapland, that he observed the commencement of the barley harvest on the twenty-eighth of July, although the seed had been sown only a few days before mid-summer; the grain was then ripe, though not more than six weeks had elapsed between seed-time and harvest.

Barley is not so nutritious as wheat; it contains less gluten, more starch, and a small quantity of sugar, which latter wheat does not possess previous to fermentation, as when preparing for bread and germination. The average length ot a grain of barley is one third of an inch, which is the linear dimensions of a *barley-corn*—a measure formerly in use in England.*

The cultivation of barley is very extensive, as may be inferred from the immense amount of malt liquor that is consumed. In Ireland and Scotland large quantities of it are distilled into whisky. A considerable amount is also used for bread, and in the

* See Ency. Brit., Art. Brewing.

preparation of pearl barley by decortication or the removal of the outer skin or bark. It is also ground into meal and thus used for fattening swine and feeding poultry. In ancient times horses were fed upon barley. PLINY relates that the Roman gladiators were called *Hordearii* in consequence of their use of this grain as food.*

The preparation of fermented liquors is of very ancient date. HERODOTUS states that the people of Egypt, being without vines, made their wine from barley.† DIOSCORIDES, one of the ancient Greek writers, also attributes the preparation of fermented liquor and the cultivation of barley to the Egyptians. PLINY, in his Natural History, gives the Egyptian name of this liquid as *Lythum*.‡ An intoxicating drink, used among the lower order of people, is made from this grain at the present day, both in Egypt and Nubia, and is there called *Bouzah*. The same people boil the green ears of barley in water and eat them with milk. TACITUS also informs us that, at the period in which he lived, the Germans prepared beer from malted grain.

The Anglo-Saxons drank ale and mead; wine was a great luxury for their people of rank. In the Saxon Decalognes, preserved in the Cotton Library in the British Museum, a boy, who is questioned upon his habits and the uses of things, replies to an inquiry as to what he drank, "Ale, if I have it, or water, if I have it not," and adds, "Wine is the drink of the elders and the wise." Ale was then, as at this day,

* Book xviii. c. 7.

† Lib. ii. chap. 78.

‡ Nat. Hist., lib. xxii. chap. 25.

sold to the people in houses of entertainment; but a priest was forbidden by a law to eat or drink at *ceapealethium*, literally a place where ale is sold.*

After the Norman conquest wine became more commonly used, and the vine was extensively cultivated in England. The people, however, held to the beverage of their forefathers with great pertinacity. Neither the juice of the grape nor of the apple were general favorites. The vassal song of the fifteenth century, whose burden was

"Bring us home good ale,"

is indicative of their attachment to that beverage. "The old ale knights of England," as CAMDEN calls the sturdy yeomen of this period, knew not, however, the ale to which, in the next century, hops gave flavor and preservation.

Hops appear to have been employed in the breweries of the Netherlands as early as the fourteenth century, but in England they were not generally used in the composition of beer till nearly two centuries afterward. It has been affirmed that the planting of hops was forbidden in the reign of HENRY VI.; and it is certain that HENRY VIII. forbade brewers to put hops and sulphur into ale.† In the fifth year of the reign of HENRY VI., it would, however, appear that the royal and national taste had for a time changed, for privileges were then granted to hop grounds. TUSSER, in his Five Hundred Points of Good Husbandry, printed in 1557, thus sings the praises of this plant:

* Turner's Anglo-Saxons, vol. iii.

† Archæology, vol. iii.

"The hop for his profit I thus do exalt,
It strengtheneth drink and it flavoreth malt;
And being well-brewed, long kept it will last,
And drawing abide, if ye draw not too fast."

In the reign of James I. the plant was evidently not sufficiently cultivated in England for consumption, as there is a statute of 1608 against the importation of spoiled hops. In 1830 there were forty-six thousand seven hundred and twenty-seven acres occupied in the cultivation of hops in Great Britain; and in 1845 the large amount of three thousand five hundred bales was imported into that country from the United States.

Above thirty million bushels of barley are annually converted into malt in Great Britain; and more than eight million barrels of beer are annually brewed there, of which four fifths is strong beer.* In 1865 there were five hundred and eight million nine hundred and sixty-four thousand one hundred and seventy-six pounds of barley sent from the United States to Great Britain.

Barley is the grain that is most commonly made into *malt*. The process consists in causing it to germinate and produce a root about the length of the seed, when the germination is suddenly checked by the grain being placed on a hot kiln to dry. The object obtained by this process is the conversion of the starch into sugar, which change is termed by chemists *diastase*. After the grain is perfectly dry, the roots are removed from it by a machine made for that

* See article on Barley in "The Food of Man." Charles Knight & Co., London.

purpose, and the grain is then ground into meal, which is called malt. If the malt has been but slightly colored by heat, when brewed it will produce a pale liquid containing much sugar and nutritious matter; but, as the color is deepened, the nutritious quality is diminished.

The process of making malt-liquor consists in putting malt into water heated to one hundred and sixty degrees—a little more water being required than the bulk of malt used. From this is formed in a few hours a transparent, brownish, sweet liquid, termed by the brewers *must*. If pure starch is placed in the *must*, it will dissolve and increase the strength of the beer. To the *must* thus formed an infusion of hops is added, which gives it a bitter taste in proportion to the strength of the hop infusion, and is said to improve the liquor; it at least imparts to it an anodyne quality. The temperature is then reduced to about sixty degrees, when yeast is added, to promote fermentation; and various liquors, such as strong beer, ale, porter, and brown-stout, are formed by slight variations in the manufacture. Drugs, as *picric acid*, are sometimes fraudulently used instead of hops, to give bitterness to strong beer. The most desirable constituent in beer is malt not too much browned.

Strong beer, when carefully made, ought to contain about ten per cent of nutritive matter, which is one half as much as is contained in new milk. Hence it is used as a tonic diet and a stimulant; but, owing to its usually containing from about six to eight per cent of alcohol, too often to produce the latter effect.

Ordinary beer very readily becomes acid; but

there is a variety made by fermenting at a very low temperature—about forty-five degrees—which does not become so. In the manufacture of the latter the yeast separates and falls to the bottom, and does not act on the alcohol which preserves the liquor. It requires several weeks to accomplish this process, when the beer is drawn off; and the active nutritious portion having separated and settled at the bottom, the beer will not change and become acid by exposure. This is the *lager-beer* of Germany, but not that of the United States. It affords no nutriment whatever, and, if taken in large quantities, causes intoxication, and so saturates the system as to continue its intoxicating effect longer than any other beverage. It is, therefore, decidedly injurious to the nervous system.

In 1860 there were used in the United States for the home manufacture of malt-liquors, fifty-five thousand bales of hops—two hundred pounds constituting a bale. The demand for these liquors has been increasing for the last five years, more especially for that denominated with us *lager-beer*, of which, we are informed, there is no regular standard of quality. It differs materially from the German beer, as it readily becomes acid; and this proves that in the process of manufacture it does not deposit its yeast, which, with the alcohol forms vinegar. It is an inferior quality of beer. There are manufactured and consumed annually in the United States, three million two hundred and thirty-nine thousand five hundred and forty-five barrels of beer; while large importations are received of Scotch and Burton ale and London and Dublin porter.

CHAPTER VI.

OATS, THE ORIGINAL BREAD-GRAIN.

Oats cultivated two thousand years ago by the Celts and Germans—Known to the Egyptians, Hebrews, Greeks, and Romans—Used for bread before the more nutritious grains were introduced—Yet prized in some peculiar forms of cooking—Compared with other grains—Incidents connected with the use of cereals in England in former days—Grain was ground in a hand-mill, called a *quern*—The bread formerly eaten by the French peasantry—Wheaten-bread a great luxury in England in the last century—Fatality of the plague increased by the want of nutritious food—The "Black Death"—Oats the most readily grown of the cereals.

THE native land of the common oats (*Avena sativa*, LINN.) is not known; but, like the other cerealia, this plant has excited attention as to its original home, which has been located on the Danube. It was cultivated two thousand years ago by the Celts and Germans; and has been transported from Europe, where it originally supplied the bread-crop, to nearly all parts of the world. It was known to the Egyptians, Hebrews, Greeks, and Romans, by whom also the grain was used for bread; and it continued in common use until the more nutritious cerealia were generally introduced, when it became more and more restricted to food for the poor, and for domestic ani-

mals. Even at this day it is eaten by the Irish and Scotch, and is much prized by them in some peculiar forms of cooking it. As a grain it is quite advantageous to man. The plant can be grown where neither wheat nor barley will flourish, and it is the hardiest of all the cereals. In damp, cool locations it bears a tolerable-sized grain ; but it will not stand heat and drought well, for under such circumstances its product is very scant.

In contrasting this with other bread plants or grasses, its grain is found to contain the least quantity of nutriment to a given bulk, and but a very small portion of saccharine matter compared with barley. It was formerly made into malt, but it is not used at this day for that purpose. The meal is sometimes recommended to very delicate persons as an article for making a light diet. In Scotland it is made into porridge and thin cakes, which are eaten by all classes, the poorer almost entirely subsisting thereon.

A little book entitled "Vegetable Substances used for the Food of Man"* contains an exceedingly interesting history of the oat. From this work we transcribe a few extracts which give an idea of the use of the cerealia in England in past times.

The Anglo-Saxon monks of the abbey of St. Edmond, in the eighth century, ate barley-bread, because the income of the establishment would not admit of their feeding twice or thrice a day on wheaten bread.† The English laborers of the southern and midland counties, in the latter part of the eighteenth

* Published by Charles Knight & Co., London.

† Turner's Hist. of the Anglo-Saxons, vol. iii. p. 25.

century, refused to eat bread made of one third wheat, one third rye, and one third barley, saying that "they had lost their rye teeth."*

In a valuation of Colchester, in the year 1296, almost every family was supplied with a small store of barley and oats. Scarcely any wheat is noticed in the inventory, and very little rye.†

At that day the grain was usually ground at home in a hand-mill, called a *quern*, although wind and water mills were not uncommon. The general use of the latter machines was probably prevented by the compulsory laws by which the tenant was under obligation to grind his grain at the lord's mill; and, therefore, to evade the tax called *multure*, the labor of the hand-mill was endured. In WICKLIFF's translation of the Bible, there is a passage in the twenty-fourth chapter of St. Matthew thus rendered: "Two wymmen schulen (shall) be gryndynge in a querne." HARRISON, the historian, two centuries later, states that his wife ground her malt at home upon the quern.

The author of "The Food of Man" states that the English laborers had better food than the French, who, in the fifteenth century, were thus described by FORTESCUE: "Thay drynke water, thay eate apples, with bread right brown, made of rye." LOCKE, traveling in France, in 1678, remarked of the peasantry, in his journal, "Their ordinary food, rye bread and water."‡ A century earlier HARRISON said of the agricultural population of England: "As for wheaten bread they eat it when they can reach unto the price

* Eden's Hist. of the Poor, vol. i. p. 526.

† Capital and Labor, p. 68.

‡ Lord King's Life of Locke.

of it, contenting themselves, in the mean time, with bread made of oats or barley, a poor estate, God wot!" This last-named author, in describing the different kinds of bread eaten at that day, after giving a description of several varieties, states: "Of the latter (brown bread) there were two sorts; one baked as it cometh from the mill, so that neither the bran nor the floure are any whit diminished. The other hath no floure left therein at all; and it is not only the worst and weakest of all the other sorts, but also appointed in *old time* for servants, slaves, and the inferior kind of people to feed upon. Hereunto, likewise because it is drie and brickle in the working, some add a portion of rie-meale in our time, whereby the rough drinesse thereof is somewhat qualified, and then it is named mescelin, that is, bread made of mingled corne."*

In the Household Book of Sir Edward Coke, in 1596, will be found entries of oatmeal for the use of the house, besides "otmele to make the poore folkes porage." About 1750 there was so small a quantity of wheat used in England that it is stated in Eden's "History of the Poor:" "In the county of Cumberland, it was only a rich family that used a peck of wheat in the course of the year, and that was used at Christmas. The usual treat for a stranger was a thick oat cake (called haverbannock) and butter. About this time, an old laborer of eighty-five remarks, that, when he was a boy, he was at Carlisle market with his father, and, wishing to indulge himself with a penny loaf made of wheat flour, he searched for it for some time,

* Percy's Preface to the Northumberland Household Book, Nicholas's edit. p. xiv.

but could not procure a piece of wheat bread at any shop in the town."

We would here request attention to a very important consideration in relation to the influence of nutritious food; and would ask, Is it not the primary modifying influence that supplies the power of resistance to the encroachment of malignant disease? We believe that all other sanitary means are only auxiliary in a minor degree; and that the fatality of the plague, which so fearfully destroyed mankind, was greatly increased by the enfeebled condition of the lower classes, living in crowded cities, and subsisting upon such meagre diet as the historians of the period describe; for, from 1296 to 1797, the period covered by our extracts, more fearful scourges visited the earth than have been known of before or since.

One of the most fatal epidemics, if not the most fatal that history records, was that which is known as the "Black Death," and occurred in the fourteenth century. It is said to have originated in Cathay, (China,) and to have traveled west, observing the course of plagues generally, as did the epidemic cholera which has visited us several times. That most terrible pestilence commenced in 1345, and continued its ravages with such destruction that at least one half if not two thirds of the human race perished in about eight years. It was most fatal in cities, and fell principally upon the poorer classes of society. In some places it only left one out of three, or one out of five, and many were wholly depopulated. In London, 50,000 dead bodies were buried in one graveyard; in Venice, 100,000 persons perished by it; in Florence,

the same number; and in Lubec, 90,000. In Asia, it destroyed nearly twenty-four millions in one year. In Spain, the disease raged three years, and carried off two thirds of the people. This plague remained in England about a year, and during that time scattered such destruction that out of the whole population hardly one person in ten was left alive. In Ireland, great havoc was made among the English settled in that island, but the native Irish were little affected, particularly those who dwelt in hilly districts.

Plagues of more or less severity visited the world up to the end of the eighteenth century; but the plague proper has, from that date, confined itself to a few outbreaks in oriental cities. It has entirely disappeared from the rest of the world since agriculture became a studied science, and the people found themselves liberally supplied with nutritious food.

Oats are the most readily grown, under unfavorable circumstances, of all the cerealia; and it is to this cause we may infer that they were more cultivated than any others of the cereals during those early periods in which the world possessed so limited a knowledge of agricultural science. Farming was then considered as but a mere drudgery that was forced upon a certain class by the increase of population.

CHAPTER VII.

RICE; ITS USES AND CULTIVATION.

Rice a marsh plant—Known 3000 years before the Christian era—Contains the least nutriment of all the cerealia—Is much cultivated in all warm climates—Was known to Strabo, and grown in Babylon and Syria—Its great value in North-America—When introduced, and by whom—The rice grown in Carolina and Georgia is the finest in the world—Rice is made into various dishes of cookery—Is boiled and eaten with milk or molasses—An excellent diet for children—Prevents thirst when eaten after salt meats—The effects of fluids in regard to digestion—How to remove the ailments caused by over indulgence in rich food—The cultivation of rice in Georgia and South-Carolina—The bobolink, or rice-bird—Its destructive habits in the rice-field—The Chinese make a kind of wine out of rice, and the people of the East distill from it ardent spirits.

RICE (*Oryza sativa*) is a marsh plant, indigenous to a warm climate, and was known 3000 years before the Christian era. It has a near resemblance to barley in its growth, but it contains the least nutriment of all the cerealia. It is supposed to have originated in the East-Indies, and, it is stated, in the Sunda Islands. It is now, and has been for ages past, cultivated in the whole of Southern and Eastern Asia, in Northern Africa, and in Southern Europe. It was known in the days of Strabo, and was grown in Babylon, Susiana, and Syria. It was introduced into

Sicily by the Arabians. In the empire of China and throughout the continents and islands of the East-Indies, the people live almost exclusively on rice and olive oil; for rice is the reliable food of those parts of the Old World.

The introduction of rice into the North-American colonies has proved to be one of the great events which has contributed to the accumulation of wealth in our Southern States, and was the result of a fortuitous circumstance. It occurred in the year 1694, when Thomas Smith, a planter of South-Carolina, an enterprising gentleman and much praised for his prudent administration, was Governor of that colony.* A vessel from Madagascar, on her homeward voyage to Britain, happening to call at Charleston, the captain presented the Governor with a bag of rice, which cereal he said he had seen growing in eastern countries, where it was deemed excellent food, and yielded a prodigious increase. The Governor divided the rice between several of his friends, who cultivated it, and found the result to exceed their most sanguine expectations. And from this circumstance Carolina dates the rise of one of the staple commodities which have tended to increase her opulence.

The rice grown in Carolina and Georgia is the finest in the world, far exceeding in quality any grown in the countries whence the seed was obtained. There is a constant demand for it at home and abroad. Still, rice has never been made a reliable bread grain in this country, where it is simply employed in the production of various dishes of cookery, but by no

* Hinton's History of the United States, vol. i. p. 207.

means to the exclusion of such other bread grains as Indian corn, wheat, and rye. When boiled in the grain until it becomes tender, and then eaten with milk, it forms an excellent light diet and an admirable food for children, for which purposes it is much used in some parts of the country. Eaten with molasses, it is taken as a dessert by the laboring classes, and with much advantage to their health, particularly when it is partaken of after salted meats, as it prevents a thirst for water, the quenching of which would cause dilution of the digestive secretions. We would here remark that it is a most injurious practice, and one that becomes habitual with many, for persons, when eating their regular meals, to take a quantity of coffee, tea, soup, etc. They will also drink several half-pints of water—half a pint being the usual quantity contained in an ordinary tumbler or goblet. This habit often induces dyspepsia, and injures weak digestive powers. The same may be said of drinking large quantities of fluids of any kind immediately before eating. The direct tendency of such practice is to dilute the digestive secretions and thus to impair their wonted functions in the process of digestion.

Persons, especially those residing in cities, too often indulge in eating rich dishes and indigestible compounds, and thereby induce an abnormal condition of the stomach, which results in morbid secretions. For these a curative may be found in the drinking of large quantities of water, (whether containing mineral salts or not,) two or three hours before or after meals, and more especially if the diet is then limited to plain bread and meat, boiled rice, and fruit, no fluid being

taken during the meal. But, in all such cases, a cure would be greatly accelerated by a bracing country atmosphere, and by well-regulated exercise in order to engender strength, care being taken to avoid fatigue, which under all circumstances must be strictly regarded as an indication to take rest, and as nature's monitor to the invalid.

As the cultivation of rice in the United States is confined to a mere locality, the reader will be interested by a description of the mode of culture adopted in South-Carolina and Georgia. The ground is prepared by the furrowing out of trenches, about eighteen inches apart, which operation is performed about the first of March; the seed is then sown in straight lines, by negro women, after which the water, which has been prevented from overflowing the ground by dikes and flood-gates, is allowed to flow over it to the depth of several inches, and to remain upon it for a week. This promotes the germination of the seed; and, in about four weeks from the time that the water has been drawn off, the plant will have grown to the height of three or four inches. Then the flood-gates are again opened, and the field is once more overflowed, and continued so for about two weeks, for the purpose of destroying the grass and weeds that have sprung up with the rice. After this the water is again withdrawn and kept off, and the rice frequently hoed to keep down the weeds and loosen the soil about the roots. It is reaped about the first of September, the harvest sometimes continuing to October. The work is done by negro men and women, who suffer much from sickness during its performance.

About the time the rice-heads begin to fill and the grains to be fully developed, constant vigilance has to be kept by the negro children, in order to drive off what is known in that locality as the *rice-bird*, but, from the peculiarity of its note or song, is called in the Northern States the bobolink. This being a very musical bird, it is much prized as a cage bird, and, among naturalists, bears the name of the *Emberiza oryzivora*. The male bird is rather handsome, and is six or seven inches long. The head and under part of the body are black; the back is a mixture of black, white, and yellow; and the legs are red. In spring and early summer these birds breed in the Northern States, and, about the beginning of August, migrate to the rice-fields, first visiting those of the island of Cuba, where the crop ripens the earliest, and then proceeding to those of South-Carolina and Georgia. They migrate in the night and in immense flocks, and are heard by the sailors at sea as they pass over the ocean on their way to the rice-fields, where in a few weeks they get so fat as to be enabled only to fly with difficulty. They are often shot, and eaten as a great delicacy.

The Chinese make from rice a kind of wine which resembles a white wine known as *Xeres*; but the mode of manufacture is not known to others. In the East, ardent spirits are to a considerable amount manufactured from this cereal.

CHAPTER VIII.

INDIAN CORN AND ITS PREPARATIONS.

Indian corn indigenous to America—Cultivated by the Indians, but not mentioned by the first voyagers to Virginia—Hospitality of the natives—During Grandville's second visit, Lane learned to smoke tobacco, and afterward introduced it into England—Captain Smith obtained maize from the natives—First slaves introduced into Virginia—Maize now cultivated in Egypt, India, China, Greece, and Italy—The Mexican Indians prepared sugar from maize, also spirituous liquors and common drinks—Large quantities distilled in the Southern and Western States—Used for fattening cattle—Its fattening and muscle-making properties compared with those of other plants—Agricultural products of the United States—Unripe corn considered a delicacy—Preparations from corn—Corn-bread only suitable food for healthy persons—Much eaten in the Southern States—Why it is not injurious—Cooling effect of perspiration—Carbonaceous food generates fat, bile, or sugar—Starch conduces to diabetes—Proper food for a warm climate, and for children confined to the house.

INDIAN CORN, or Maize, (*Zea mays*,) being so common in the United States, requires no description. Naturalists all agree in determining its native region to be America, where the Indians were found cultivating it when the country was first discovered; although it is strange that it was not seen, or rather is not related to have been seen, by the first voyagers to Virginia in 1584.* The historian states that

* Hakluyt, vol. iii. pp. 248, 249.

Amadas and Barlow, on making their first visit to that colony, near the mouth of Albemarle Sound, were several times visited by the natives, and finally made a visit to them on an island called Roanoake, some twenty miles up the river. When they came to the island, they found at the north end a village of nine houses, built of cedar and carefully fortified. Here they were received by the wife of an Indian chief named Granganimo, who, after they had dried themselves, placed before them to eat some "wheate like fermente; sodden venison and roasted; fish, sodden, boyled, and roasted; melons rawe and sodden; roots of divers kindes; and divers fruits." The drink of these people was found to be commonly water, but, adds the narrator, "while the grape lasteth they drinke wine, and, for want of caskes to keep it all the year after, they drinke water, but it is sodden [which must mean prepared] with ginger in it and black sinamon, and sometimes sassafras and divers other wholesome and medicinable herbes and trees." In the friendly repast offered the travelers there is no mention of Indian corn, unless the "wheten ferment" was made of it, and what renders this view most probable is that wheat was not cultivated or known by the natives.

This chief's wife (and, if a fair representative of the people, they were most hospitable) tendered her guests the utmost kindness with the greatest possible simplicity. The narrator states that "she commanded her people to drawe the boate on shore from the beating of the billoe, others she appointed to carry us on their backes to the dry ground, and others to bring our oars into the house for fear of stealing. When we

were come into the outter roome, having five in her house, she caused us to sit downe by a great fire, and after tooke off our cloathes and washed them, and dried them againe; some of the women plucked of our stockings and washed them; some washed our feete in warm water, and she herself tooke great paines to see all things ordered in the best manner she could, making great haste to dresse some meate for us to eate.

"We were entertained with all love and kindnesse, and with as much bountie, after their manner, as they could possibly devise. We found the people most gentle, loving, and faithful, voide of all guile and treason, and such as live after the manner of the golden age. Their meat is very well sodden, and they make broth very sweet and savorie; their vessels are earthen pots, very large, white, and sweete; their dishes are wooden platters of sweet timber."

In 1586, GRANVILLE made his second voyage, and HERIOT described the inhabitants and the country. LANE, the associate of GRANVILLE, then learned to smoke tobacco and relish it, and was the first to introduce the commodity into England. Since that early period, the propensity to indulge in the intoxicating influence of this nauseous weed has so increased that 267,267,920 pounds were sold in the United States in the year 1865; the average cost of manufacturing it being probably about one dollar per pound. This useless expenditure of money for a worse than useless indulgence would pay our public debt of two and a half billions in less than ten years.

In May, 1607, Captain JOHN SMITH obtained corn (*maize*) from the natives in Virginia, and he states

that it became the common food of the new inhabitants, and was not only their main reliance for many years, but the favorite bread grain in that part of the country of the white people, the natives, and the slaves; some twenty Africans having been purchased, in June, 1619, from a Dutch ship in the James river. These were the first slaves introduced into the colonies; and their introduction inflicted upon us a most grievous ill, which time atoned for by the sacrifice of several hundred thousand lives.

It is admitted by all that maize or Indian corn was unknown to Europeans before the discovery of America. It is now cultivated in Egypt, India, and China—to the inhabitants of which countries it was also unknown previous to the discovery of this continent—and it is likewise raised in Greece and Italy. It grows and produces grain in America from the southern tropic to 50° north latitude. In Africa it is cultivated on the western coast and to some distance in the interior; and on the northern, upon the lands bordering the Mediterranean. It is supposed to be indigenous to Central America, and was, it is stated, carried to Mexico by the Zoltecs. The Peruvians make it their principal bread grain, and use it in various preparations. The Mexicans dedicated this grain, as the first-fruit, to their god Cintentl, (from Centli, maize,) in a similar manner to the dedication of wheat by the Greeks to their Demeter.

Humboldt states that the Mexican Indians, previous to the conquest of their country, were accustomed not only to express the sweet juice from maize-stalks, for the purpose of fermenting it into intoxicat-

ing liquor, but that they boiled it down to the consistence of a sirup, which, in his opinion, they were able to make into sugar. In confirmation of this opinion he recites a letter written by CORTEZ, who, in describing to the Emperor CHARLES V. the various productions, both natural and manufactured, which he found in the new country, asserts that among these were seen "honey of the bees and wax; honey from the stalks of maize, which are as sweet as sugar-cane; and honey from the shrub which the people call *moguey*. (*Agave Americana*.) The natives make sugar from these plants, and this sugar they also sell."

HUMBOLDT further informs us that the Mexican Indians still produce from the juice or sugar made from maize several fermented liquors, some of which resemble beer, while others are like cider; and a spirituous liquor called *pulque de mahis*, or *thaouili*. Other more common beverages made from maize are known in that country by the name of *chicha*.

In our Southern and Western States, large quantities of Indian corn are distilled into spirituous liquor. This grain constitutes the principal crop raised in many localities, where it is used not only for distillation, but for the fattening of hogs and cattle, and for the food of the people. Whisky, hogs, and cattle are found to be more readily transported to market, and with less expense, than the grain.

Corn is supposed to be one of the most profitable crops of grain grown in the Western States. With a little extra cultivation, there have been raised 263 bushels of Indian corn upon one acre of

ground in the State of Indiana, and not upon a single acre, but upon each one of a ten-acre field. Under ordinary circumstances from 115 to 180 bushels have been gathered per acre off rich alluvial soil.

The authority from which we derive the last-named facts states that a vast portion of the crop is consumed by turning hogs out upon it as soon as the grain begins to harden, about the middle of September. By this means the produce of the land is returned to the ground, in the form of the rich manure of the hogs, which only take away the increased fat they accumulate. This mode has sustained the soil in producing great crops.

The advantages of employing Indian corn for the fattening of these animals will be elucidated by a comparison of the amount of fat-producing material contained in that grain with the amount found in the potato, and by contrasting the total amount an acre of land will yield from the two products. For the first we have the well-ascertained fact that 100 pounds of corn contain 73 pounds of fat-producing elements, and that the same number of pounds of potatoes contain only 55 pounds of those elements. And, if we adopt this basis, and calculate that an acre of well-cultivated land will produce 180 bushels of corn or 200 bushels of potatoes, which at 60 pounds to the bushel will give a total of 10,800 pounds of the former and of 12,000 pounds of the latter, we find that the crop of corn will yield 7884 pounds of fat-producing elements, while that of potatoes will supply only 6600 pounds. This exhibits a difference of 1284 pounds, or more than twenty per cent, in favor of corn

—an important consideration to the farmer in feeding stock, whether for market or for home consumption.

As we have here introduced the subject of comparison as to the organic elements of corn and potatoes, we will state the comparative quantity of muscle-making elements contained in each. In Indian corn we have about twenty-seven per cent of muscle-producing material, and in potatoes forty-five per cent. Consequently, a man must eat a largely increased weight of corn to that of potatoes to obtain an equal amount of strength; and thus potatoes are superior to corn as a nutriment for man. Wheat-flour, however, contains over sixty per cent, and affords more than double the nutriment contained in Indian corn; therefore, in an economical point of view, wheat-flour is the cheaper. The average price in the port of New-York for Indian corn, per bushel, for four years, was seventy-seven cents; and of wheat, per bushel, for the same time, one dollar and fifty-six cents. This determines that wheat produces the most economical bread in our cities, and it is without doubt the most palatable to the poor. To make up the deficiency in quantity, in order to satisfy the appetite, potatoes are the most suitable for persons who are either unaccustomed to eating corn-bread, or to whom it is unpalatable. Those who have been accustomed to eat it prefer it to all others; and it is more or less eaten by our native-born citizens in all parts of the country. By them corn flour is frequently combined or mixed with flour made from wheat, rye, or buckwheat; but there is only a small portion of flour thus mixed consumed in bread in comparison to the amount grown.

Indian corn is the leading agricultural product of the United States, as set forth in the census returns for 1860, during the ten years previous to which the country was most prosperous. The following table gives the production of the leading staples of the country in the year in which the census was taken, with the value of the crop of each at the average wholesale prices of that year:

Products.	Quantity.	Price.	Value.
Indian Corn......bushels	838,792,740	$0 77	$645,870,410
Wheat........... "	173,104,924	1 56	270,043,681
Oats............. "	172,643,185	0 43	64,236,570
Cotton ....pounds	2,154,820,800	0 12	258,578,496
Tobacco.......... "	434,209,461	0 8	34,736,757
Rice.............. "	187,167,032	0 4½	8,419,816

A large amount of Indian corn is eaten before it has fully hardened in the ear, and, when rather hard, is very irritating to the stomach and bowels of delicate persons. In this unripe state, when boiled in the ear for the table, it is generally considered a delicacy, especially the variety known as "sweet corn." Of other varieties, when ripe, numerous dishes are made from preparations known as samp, hominy, farina, grits, and flour of the farina. The latter is designated as *corn-starch*, and is made into delicious puddings and delicate preparations very suitable for the sick. Both bread and cake are made out of corn-meal; and the higher classes of persons have expensive compounds produced from it by the

addition of eggs, milk, and sugar. These compounds are palatable and nutritious, but very hard to digest; and, consequently, have a tendency to generate acid in the stomach.

Corn-bread is only a suitable diet for hearty persons who have plenty of exercise in a free, pure atmosphere, whereby the fat generating portion can most readily be expended; for a large amount of it must be eaten in order that a sufficiency of the muscle-making portion may be obtained to afford strength to labor.

Here the question arises, Why is it that corn-bread is eaten to the greatest extent in our Southern States, and during the warm summer season, with comparative impunity? The reply is, that nature has made ample provision in the animal economy for the relief of the system under such circumstances; and thus we have the skin performing an important function, that of secreting perspiration, much of which passes off in the form of vapor. For it is a well-known law in the science of chemistry that water, in assuming the form of vapor, absorbs much heat from the body. The operation is identical with that of cooling water in a porous jug. A portion of the water contained in it percolates the porous material of which the jug is made, and is evaporated by the heat of the sun; but that portion, before leaving the jug, absorbs an additional amount of heat from the remaining water, and thus deprives it of the warmth that constituted it in equilibrio with the heated atmosphere. By this means the water remaining in the jug is rendered much cooler than the atmosphere. And it is in a similar way that the body is relieved of its excessive heat.

We would here direct attention to a fact in relation to a person who is perspiring freely. The skin, if tested with a thermometer, or even with the hand of a person not perspiring so freely, will be found to be much cooler than many of the surrounding bodies. The skin thus cooled condenses much of the secreted fluid, and perspiration will be noticed to flow over the surface. Thus it is that the internal parts of the animal body, if in a healthy condition, are found to maintain the same degree of heat under all the variations of temperature in different climates, and after eating of various kinds of food. When the food contains much of the carboniferous substances and is not consumed in respiration, it generates in the system fat, bile, or sugar, each of which tends to an abnormal condition of the system, more or less serious, fat being the least dangerous. Bile is the excitant of fever in various degrees of virulence, the more moderate forms of which are curable. Sugar, when generated in the system, produces excessive secretion from the kidneys, and, as we have said, constitutes the disease known as *diabetes*, which is commonly considered to be incurable, but is providentially seldom induced.

These remarks apply equally to all kinds of farinaceous food, and are of importance in proportion to the quantity of starch such food contains. They are also applicable to oleaginous food—to fat and butter—and to molasses and sugar, all of which are subject to the same transformation as starch, more especially if quietude is indulged in. Motion, or exercise in the open air, by causing an increase of perspiration, is the only reliable means of relieving the system when

it becomes overpowered or burdened by the excess of unsuitable diet, or by the heat of a tropical climate or a warm, close room. If persons thus situated would only submit themselves to a limited diet of wheat bread, fruit, a small quantity of lean meat, and to water for a drink, a tolerable condition of health might be regained, providing the mind were tranquil, and a systematic regulation were adhered to in taking food and rest. These hygienic observances should be especially enforced in all cases where children are confined in the nursery-rooms of our modern houses that are heated by hot air and lighted with gas; the only exception being, that the growing child requires more food than an adult, and plenty of exercise of both body and lungs.

CHAPTER IX.

BUCKWHEAT AND ITS VARIETIES.

Buckwheat, called in Germany *beech-wheat*, introduced into Europe in the sixteenth century—Has no affinity with the cerealia—Is used very extensively as a bread grain—When green is excellent fodder for milch cows—The grain is good for domestic animals—Affords more muscle than corn—Is hard to digest—In Dantzic it is largely distilled into spirits—The several varieties of buckwheat and analogous grains.

BUCKWHEAT, (*Polygonum fagopyrum*,)—or, as it is called in Germany, from the resemblance of the seed to that of the beechnut, *beech-wheat*,—is said to have been introduced into Europe in the be-

ginning of the sixteenth century, and is supposed to have been brought thither from the north-western regions of China, whence it was distributed by the Saracens. It is now cultivated in the whole of Middle and Northern Europe, as well as in Northern Asia. In Northern India and Ceylon it is confined to narrow limits, and is there of very recent introduction, comparatively speaking.

Buckwheat has no affinity with the cerealia; it belongs entirely to a different family of plants; but we notice it in this place because it is one of the bread grains used by man as food, and in the United States to a very considerable extent. In England it is not so used, but grown as fodder for cattle. When used as green fodder and given to cows, it is said to increase to a great extent the excellence and quantity of milk. Much value attaches to it in consequence of its bearing great drought, and remaining green when all the other grasses in the meadows are dried up. It is also prized for its nutritive qualities when given in the grain to poultry; and thus it is grown in England in secluded places for the feeding of pheasants and their preservation. The grain, when coarsely ground and mixed with oats, likewise constitutes excellent food for horses; and, when used alone, for the fattening of hogs, which proves that it contains a large quantity of starch. It ferments most readily—much more so than Indian corn, as it contains more gluten or fibrin—and it consequently affords more strength or muscle-making material than the latter; but it is very difficult to digest, and it is therefore only fit food for laboring people. The bread made from buckwheat flour, like that

made from common maize, is, when cold, heavy and insoluble; which indicates the excessive amount of starch those grains contain compared with wheat. In Dantzic, large quantities of buckwheat are distilled into spirits of a fine quality, and are used in the manufacture of cordials.

Several varieties of this grain are used in different parts of the world as food for man; but, as they are but little grown in our country, we will merely give them a passing notice.

Polygonum tartaricum is of the same family as our common buckwheat, but of a stronger growth. It was introduced into Europe at a much later period than that plant, and is there used for enriching the soil by plowing it under when green, and leaving it to decay. Another variety, known as *Polygonum emarginatum*, is grown in China and Nepaul. It is quite equal to the variety grown by us, one bushel of seed producing from forty-eight to fifty bushels of grain; and its cultivation is very advantageous to the farmer, as it is often grown in ground that has been planted with wheat or rye in the fall, but the crops of which have been destroyed in the winter and spring. The farmer is thus enabled to obtain a crop of buckwheat, sufficient to remunerate him for his labor in preparing the ground for an unproductive wheat or rye crop.

On the discovery of America, the inhabitants of New-Granada, Peru, and Chile were found cultivating a somewhat similar grain, which they still grow, and find very productive; and it is rather remarkable that this particular grain has never been disseminated to other parts of the world. It is the *Quinoa*

chenopodium, (WILL.) and constitutes the bread of the inhabitants.

The white quinoa is cultivated in Europe for its leaves (which are very like spinage) but not for the seed.

The native inhabitants of the East-Indies cultivate as a bread grain the *Amarantus frumentaceus*, (ROXB.) It yields quite equal to the quinoa, and is grown extensively on the mountain slopes of Mysore and Coimbatore.

CHAPTER X.

MILLET, SORGHUM, AND IMPHEE.

Millet commonly grown in the East-Indies—Was known to the Greeks and Romans—The several varieties—The *Sorghum saccharatum*, a native of India—Its introduction as a sugar producing plant into the United States—*Imphee*, or African sorghum—The sorgho flourishes in the various climates of the Union—Its numerous merits—Its manufacture into sugar—Its general use—The stalks form nutritious fodder for cattle—Yield of sugar and molasses per acre—Various methods adopted to obtain the same—Alcoholic drinks manufactured from the sap—Uses to which the seeds, husks, etc., can be applied—Mode of cultivating sorghum—Expenses attendant upon cultivation and manufacture, and the profit per acre—Means of testing the presence of acid in molasses—How meat is preserved with molasses—Importance of the sorghum plant—Invaluable uses of molasses.

THE common *Millet*, (*Panicum miliaceum*,) commonly grown in the East-Indies and other warm regions of Asia, is very little inferior in productiveness and profit to rice. Although a very small

grain, it yields most abundantly, owing to which circumstance the name *mille* (a thousand) has been derived from it. This grain was known to the Greeks and Romans at the time of JULIUS CÆSAR. STRABO states that it throve excellently in Gaul, and was the best protection against famine. The Sclavonians are said to be very fond of a dish made from it, and called by them *Kasha prosna.* It is believed by some writers that it was this grain, and not the Indian millet, (*Sorghum vulgare,*) that the Emperor CHINANG introduced into China three thousand years ago. Major DENHAM, when traveling in Central Africa, found a species of millet to be the grain most in use among the people of all classes in Bornou, and upon which their animals also were fed. It was produced in great quantities, and with scarcely any trouble. The poorer people ate it raw, or parched in the sun, and were satisfied without any other nourishment for several days together. Bruised and steeped in water, it formed the traveling stock of all pilgrims and soldiers. When cleared of the husks, pounded, and made into a light paste, in which a little *meloheia* (the *eboo ochra* of Guinea) and melted fat were mixed, it formed a favorite dish, and was called *kaddell.**

There are several varieties of millet, which are designated by their color only, as they do not vary in quality or size of seed; some of these are single-spiked, and others much branched. Europe claims one variety known as *Setaria Germanica;* and another, *Setaria Italica*, which is generally grown to feed birds and poultry.

* Denham and Clapperton's Travels, p. 316.

The variety of millet that most especially demands our attention is the *sorghum*, which is known by a diversity of names in the different countries where it is grown. In India it is called *jarara;* in Egypt and Nubia, *dhourra;* and in the West-India Colonies, *Guinea corn*, the seed having been conveyed thither from the western coast of Africa, where it is called *imphee.*

The golden-colored seed produced by the *Sorghum saccharatum* is much used, and in a similar manner to rice, for puddings. The plant is a native of India, and is cultivated largely in China and Cochin China. It was introduced into the island of Jamaica, and recently into our own country, as a sugar-producing plant for our South-Western States. The variety known as *imphee*, or African sorghum, has been still more recently introduced for the same purpose. There is, however, but a slight difference in the two varieties, probably a mere climatic change. The *imphee* is said to be more uniform and vigorous in growth than the other, and to contain the purest saccharine matter; but much of this, we presume, depends upon soil, climate, and favorable seasons.

The first reports on the culture of sorghum to any considerable extent in the United States appeared in 1856, the plant having been introduced into the country but a few years previous. In that year, Mr. H. S. Olcott, of the Mount Vernon Farm School, State of New-York, read a very interesting paper* upon the subject before the Farmers' Club of the American

* Reported in the Transactions of the American Institute, 1856, p. 324.

Institute, in which paper he stated that the possibility of raising the *sorgho* in this country, even to the complete maturity of its seeds and the extraction of sirup from its juice, had been proved by actual experiment in Massachusetts, Vermont, Connecticut, New-York, Pennsylvania, New-Jersey, Ohio, Indiana, Illinois, Maryland, Virginia, District of Columbia, North and South-Carolina, Georgia, Alabama, Louisiana, Missouri, and Kansas, in all of which States, a greater or less amount of seed had been sown.*

The fact of the adaptability of the plant to these wide extremes of territory makes its introduction to the list of our economic plants a matter of general interest; and especially at a period like the present, when there exists a general fear with regard to the future productiveness of our sugar plantations. We therefore present an exposition of its various merits, the subject being one that is daily increasing in its importance.

As a sacchariferous plant, its superiority to the ordinary sugar-cane consists:

1st. In its adaptability to all varieties of latitude as far north as the forty-fourth parallel.

2d. In its being propagated from its own seed, which is obtained in connection with the saccharine matter.

3d. In its ripening at a more convenient season of the year.

4th. In its yielding two crops in a season.

* The cultivation of this very useful plant is, at this time, 1867, but very limited, being undertaken by but a few individuals in each of the States named.

From the first of these peculiarities, the smallest farmer in the New-England, Middle, or Western States is enabled to manufacture his own molasses and sugar, and is thereby relieved from the increased expense for these necessaries of life which is always attendant upon a failure of the crop of Southern cane; while the peculiar luxuriance of the sorgho in warmer latitudes makes it there a formidable rival to that plant. The great trouble and expense attendant upon procuring and saving the cuttings of the cane are entirely obviated with the sorgho; and consequently, even though the actual yield of sugar per acre is much less from the latter than the former, it will be more likely to prove remunerative to the planter. The sorgho ripens three months before the cane, being ready for crushing in the State of Louisiana throughout August and September. It thus perfects its seed in full time to escape frost, and its crop is, therefore, far less liable to failure than that of the cane.

The uses of the sorgho are so various, every part and portion of the plant being valuable, as to have obtained for it from the *National Intelligencer* the name of "vegetable sheep." A few of these uses we will enumerate:

1st. *Soiling Cattle.*—It gives two and even three crops of succulent stalks, which are very nutritious and grateful to stock. In July, the sorgho cane will have attained a growth of five or six feet, and, if then cut down for fodder, *rattoons* (young shoots) will spring up from the stands or stubble, and yield a bountiful harvest in the ensuing September and Octo-

ber. In Georgia, Mr. REDMOND has obtained three crops of fodder; and in South-Carolina, Governor HAMMOND has obtained sugar and seed fully ripe from the second crop, that is, after he had obtained one crop of fodder.

2d. *Yield of Sugar.*—M. AREQUIN, of Louisiana, calculates its product of good crystallized sugar at 1000 pounds to the acre; while M. VILMORIN, of France, puts it at 2386 pounds.

Each thousand pounds of sugar will drip fifty-five gallons of molasses; but, if the object of cultivation be simply to obtain sirup, then we may count upon a product of four hundred gallons per acre under favorable circumstances. Colonel PETERS, of Georgia, obtained four hundred and sixty-eight gallons, and this, too, with very incomplete apparatus. From all parts of the Union, reports have been received of the successful production of sirup and sugar from the sorgho sap. It has been obtained by various methods. One person pounded his stalks with a rolling-pin, next boiled them, and then evaporated the excess, water. Another crushed them with an ordinary grocer's sugar-mill, after which he twisted them and rinsed out the sap, from which pure sirup was obtained by boiling it in a sauce-pan. Still another cut the stalks into small pieces, which he boiled in water without any preparatory crushing or bruising; while a fourth squeezed out the sap, by means of a pair of horizontal rollers, geared to an equal speed and driven by a couple of mules. But various as these methods are, they all establish the absolute presence of sirup in the sorgho sap, in the different States from whence

the reports have come; and to obtain from it the largest amount of sugar possible, it is only necessary to apply the means adopted in the manufacture of cane-sugar, as previously pointed out in this work.

Governor HAMMOND is of the opinion that the younger sorgho-canes are richer in saccharine principle than the older ones; but the experience of Professor HENZE in France, and that of Mr. OLCOTT at the Farm School, indicate that the extreme richness in the sugar is attendant upon the full maturity of the seed. However, if the canes are allowed to remain uncut for some time after the seed has turned red and passed the milk state, a smaller per cent of sugar will be obtained.

The Zooloo Caffres increase the sweetness of the sap by cutting off the tops of the plants just as the seed-heads begin to show themselves. A like practice was successfully pursued in the United States in the previous experiments to make sugar from sweet corn.

3d. *Alcoholic Drinks.*—From the sap of the sorgho may also be obtained several fermented alcoholic drinks, such as brandy, rum, pure alcohol, and cider. M. AREQUIN, however, says that the sorgho cognacs are greatly inferior to the usual ones; but this difference, Professor HENZE remarks, is distinctly and entirely due to the imperfect methods of manufacture. M. VILMORIN calculates the product of alcohol per acre at 180¼ gallons.

4th. *Uses to which the Seeds, Husks, etc., can be applied.*—The seeds make a good meal, which has been prepared into cakes that have been pronounced almost equal to those made from buckwheat. The seeds,

too. are much relished by cattle, hogs, horses, and fowls. M. Sicard, a manufacturer of Marseilles, has successfully used the hulls of the seeds for the production of a beautiful carmine for dyeing his linen and cotton goods. The *National Intelligencer* of Washington City states that the sap, if set with oxide of tin, gives a pink color to silken fabrics. Also that, after the seed has been removed from the tassels, the latter may be made into brooms, and answer for that purpose almost as well as broom-corn. The usual yield of seed per acre is about twenty-five bushels, of thirty-six pounds each, but in some cases it is even more, and in others less.

The soil most suitable for growing sorghum is rich sandy loam or bottom land; but it will flourish very well on coarse gravelly soil, if care is taken to keep down the weeds, and, when planting it, to allow plenty of room. The seed should not be covered more than half an inch with fine mould, and previous to planting should be soaked in hot water for a few hours. After the plants have made their appearance above the ground, the soil should be freely stirred with the plow, so as to keep it loose about the roots. Mr. D. M. Cook, of Mansfield, Ohio, states* the expense attending the cultivation and manufacture of sugar per acre in that State, in 1862, to have been as follows:

"The expense of cultivating and manufacturing an acre of sorghum is about thirty-seven dollars. It may run possibly to forty-five or fifty dollars. My cane yielded about two hundred and twenty-five gallons to

* Agricultural Report from Patent Office for 1862, pp. 311-314.

the acre, and of this about seven pounds to the gallon were crystallizable sugar, giving one thousand five hundred and seventy-five pounds to the acre."

Mr. J. H. Smith, of Quincy, Illinois, made one thousand five hundred pounds to the acre from the crop of 1861, and had, besides, one hundred and fifteen gallons of good sirup. Brown sugar then retailed throughout the West at twelve and a half cents, and the wholesale price was ten cents per pound. Molasses sold readily at forty cents, wholesale. The profits may therefore be stated to have been as under:

1500 pounds of sugar, at 10 cents per pound, ...	$150 00
115 gallons of molasses, at 40 cents per gallon, ...	46 00
	$196 00
Deduct expenses, ...	50 00
Balance, net profit, ...	$146 00

Molasses from sorghum is now being used, when perfectly free from acid, for the curing of meat. The presence of acid is easily ascertained by immersing into the molasses a slip of litmus paper thus prepared: Take half an ounce of litmus, which can be purchased from an apothecary, put it into an earthen vessel, pour over it half a pint of boiling water, and then let it stand in a warm place for two hours. Dip into this mixture slips of white wrapping-paper, which it will turn to a purple color, and then dry them, and afterward inclose them in a well-dried, wide-mouthed bottle, which must be kept from the light. When a strip of this litmus paper is used as a test, the presence of acid will turn it red or reddish in degree to the amount of acid contained in the molasses, or in any other substances to which it may be applied.

To prepare the meat for curing with sorghum molasses, it must be first covered with a strong brine for twenty-four hours, at the end of which the brine must be taken off, and subjected to the following treatment: To twenty gallons of brine add four ounces of saltpetre (nitrate of potash) and four gallons of molasses, and then boil the whole till a bright amber-colored solution is formed. When cool, carefully remove the scum, and then again pour the liquid over the meat, and let it soak it for twenty days. Hams thus prepared, and then smoked, are of superior flavor.

We have been led into these extended remarks upon the qualities and uses of the sorghum plant, in consequence of its apparent usefulness to man as food in so many different forms, and of the limited knowledge the people possess of it, owing to its very recent introduction into our country; and the statements are especially intended to invite the attention of our Northern and Western farmers to the cultivation of what may prove to them a most valuable crop, and may afford to all sugar and molasses at a cheap rate. Molasses is much used by every person who can procure it, and is given with great advantage to children to eat with their bread, as it obviates in them the desire to partake excessively of fats and gravies, which are most indigestible articles of diet, and, if composed of pork, generate diseases of the skin and eyes. When eaten by children in robust health, molasses neither becomes acid in the stomach nor possesses any tendency to impair the secretions. It is only inadmissible food for very delicate persons, in whom it is liable to produce acidity.

CHAPTER XI.

PEAS, BEANS, AND LENTILS.

Peas and beans most nutritious, but difficult to digest—For horses and oxen they exceed all other food in nutriment—The garden pea cultivated at a very remote period—The several varieties of peas—The chick-pea an object of devotion—Where it is cultivated—Much used by the Spaniards—Was the parched pulse of the Hebrews—Eastern trade in parched peas—Garden and field peas—The bean known at an earlier period than the pea—Kyanetes, the god of beans, honored by the Athenians—The bean considered an impure fruit by the Egyptians—Was in ancient times the symbol of death—Cultivated in China 2822 years before the Christian era—Is made into flour and bread by the Abyssinians—Is largely cultivated in Barbary—Varieties of beans—The kidney-bean—The lentil grown in France and Italy—Made into soup in Catholic countries as a limited diet for fast-days—Is the most nutritious of the leguminous seeds—Eaten by the Hindoos when engaged in laborious work.

THE products of leguminous plants form a very nutritious food for man, most invaluable to robust persons, but difficult of digestion by those who possess enfeebled digestive organs. Peas and beans, when matured, contain more nitrogenous matter than the cerealia. This matter is, however, in a peculiar form, and somewhat resembles that found in the curd of milk, known as *casein* or cheese, which, we have already indicated, is very indigestible, and not so soluble as fibrin and albumen obtained from lean meat.

But for the horse and the ox these products are very beneficial, as they exceed all other food consumed by those animals in the power of producing strength.

Green peas (*Pisum sativum*) and green beans (*Vicia faba*) do not contain as much of the nitrogenous matter as the matured seed, and they consequently form a most excellent diet for the summer season, as they are easily digested. When they approach maturity, people with weak digestive powers must be cautious in eating them, or serious consequences may be the result.

The common garden *pea* was cultivated in India at a very remote period, and it was also grown by the Greeks and Romans. At the present day it is found growing wild about the Crimea, and along the coast of the Black Sea; and its varieties are cultivated as far north as Hammerfest and Lapland. The *Pisum arvence*, Linn., has been extensively distributed, and is now cultivated in Egypt and in many parts of India. There are many other varieties of peas; as the Egyptian pea, (*Pisum jomardi*,) the Abyssinian pea, (*P. Abyssinicum*,) the sea pea, (*P. mauriscum*,) the Cape Horn pea, (*P. Americanum*,) and the European, or yellow flowering pea, (*P. ochrus*,) growing wild on the coasts of France and England; but none of these are eaten where other food can be obtained.

What is known in the East as the chick-pea, (*Cicer arietinum*, Linn.,) is of great importance to the people of that region. It was cultivated by the Jews, Greeks, and Egyptians in ancient times, and was made an object of devotion. The common people in Greece cultivate it for food at the present day, and not

only eat it roasted during the winter months, but use it like coffee. It is also grown in Egypt and Nubia, as far south as Abyssinia, and on the heights of Lebanon; as well as in Spain, where it is used both as a dyeing ingredient and an article of food, and is known by the name of *garvanzos.* The seed of this pea differs from that of the common pea in not becoming soft when boiled; consequently the Spaniards do not cook it as we do ordinary peas, but strew it about other dishes for ornament, except in the case of a dish called *olla*—composed of bacon, cabbage, pumpkin, and garvanzos—which forms a favorite dinner diet among those people. The chick-pea has been much esteemed among many nations from the earliest periods. It is most commonly parched, and thus prepared has continued to the present day to be an article of great consumption.

According to BELLONIUS,* this pea was the parched pulse which formed the common provision of the Hebrews when they took the field; and CASSIANUS† supposes it to have been the *torrified* seed mentioned by PLAUTUS and ARISTOPHANES. The *frictum cicer* seems to have constituted a part of the usual food of the lower orders at Rome. In Grand Cairo and Damascus quite an extensive trade is done in the sale of parched chick-peas, which are purchased as a light article of food by travelers when they are about to cross the desert. These parched peas are highly recommended as being not only a nutritious diet, but of great advantage in promoting a free secretion of saliva, on account of their being very diffi-

* Calm. Dict. Bibb. lib. ii. cap. 53. † Cassian. Collat.

cult to masticate, and thus to a certain degree they prevent thirst. They are called by the Turks who sell them *leblebby*.

The peas grown in the United States are divided into two classes, those of the garden and that of the field. Of the former there are innumerable varieties as well as various qualities. Some mature in a much shorter time than others, and some vary much in flavor; but all are prized for arriving at maturity in so short a period of time that a number of crops can be obtained in a season, and the table can be furnished with green peas from spring to autumn. The field pea, of which we have only one variety, is in constant requisition for provision for the crews of ships, on board of which an immense quantity is consumed.

The *bean* has been known from a remoter age than the pea, or, at least, it has been noticed by historians at an earlier period. Like the cerealia, it had its divinity claiming devotional service. Kyanetes, the god of beans, stood upon the sacred road to Eleusis, and to him was dedicated the feast of beans, *Kyanepsia*, which the Athenians celebrated in honor of Apollo. The bean was held sacred by the Greeks and Romans, and it was much cultivated by the Jews. By the Egyptians it was considered an impure fruit, and was not allowed even to be touched. PYTHAGORAS forbade his scholars to eat beans. In ancient times the black speck on the white flower of the plant was viewed as a mark of death; and the bean was in consequence considered to be the symbol of death. Though known to the Egyptians, the bean is not found in their catacombs, a circumstance which is probably

owing to the abhorrence they had of it. The Greeks called the *Nelumbium speciosum* the "Egyptian bean," but this is a well known water-plant, having no relation whatever to the bean family.

The Chinese cultivated the bean 2822 years before the Christian era. It was considered by them to have been one of the five different kinds of seeds that were introduced by the Emperor CHINANG, whose memory they continue to worship, esteeming him as their great benefactor.

The Abyssinians make a flour of beans, and bake bread of it. This bread is not very palatable to persons unaccustomed to it, but it is probably the most nutritious for healthy, active persons that is made. Along the northern coast of Africa beans are used as an esculent. Mr. SHAW states that beans are largely cultivated in Barbary, where they are eaten stewed with oil and garlic, and form the principal food of every class.

There are many varieties of beans, too numerous to be treated of in detail in this work; but as all are generally known among us as a common food, the omission of any specific description of them is a matter of but slight importance.

A small black bean, called by some the turtle-soup bean, is much prized by the Mexicans and throughout Central America, where it is extensively cultivated, and, when the seeds are ripe, eaten. This bean is called by the people of that section *fricollis*, and with them it is said to form a part of almost every meal. In the manner in which they prepare it travelers speak of it as being a most palatable food.

In Bornou, a kingdom of Central Africa, four kinds of beans, peculiar to the country and known by the general name of *gafooly*, are cultivated and eaten by the slaves and poorer people. A paste compounded from beans and fish was the only food that could be found there by Major DENHAM and his companions in the towns near the river.*

The *kidney-bean* (*Phaseolus*) is most commonly grown in our gardens. There are two varieties and many sub-varieties, all natives of foreign countries. The dwarf kidney-bean, (*P. vulgaris*,) a native of India and commonly called the French bean, was introduced into England in 1597. The *P. multi-floris* was introduced into the same country in 1633. The latter is our running bean, and, when growing, requires poles for support. Of this variety, there are the red and white flowering; but these do not differ in any other particular.

The *lentil* (*Ervum lens*, LINN.) is a leguminous plant grown by the French and Italians. In most Catholic countries its seeds are made into soup, which is eaten as a limited diet on fast-days; and in addition they form an ingredient in other culinary preparations. Though the lentil was known at as early a period as the bean, it has never become so widely disseminated. Dr. PLAYFAIR states that it contains more nitrogenous matter than any of the *leguminosæ*, and consequently is more nutritious, when digested, than any other of the leguminous seeds. The lentil is consumed in the East in considerable quantities; and a curious proof of its value as a nutritious diet is afforded by the use

* Denham and Clapperton's Travels, p. 317.

made of it among the Hindoos, who always have recourse to it in addition to their rice, when they are engaged in rowing on the Ganges or in other laborious work. Rice, it must be remembered, even when eaten in large quantities, imparts to the system but little strength.

PART VI.

Esculents and Fruits.

CHAPTER I.

THE POTATO.

Properties of esculent vegetables—The potato most nutritious and of the utmost value to man—Can not be superseded—Found growing wild in Chili—Indigenous to America, and thence transported to England in 1586—Arrives at its greatest perfection in the temperate zones—Quality improved by culture—Peculiar effect of cultivation upon esculents and fruits—The potato improved by change of locality—As a diet, exempts from disease—When eaten with rich food, improves the digestive functions—Its use would avert excessive mortality—Too much fluid creates a craving for large quantities of food—Value of esculents—Comparative amount of nutriment in common articles of diet.

ESCULENT vegetables contain a large amount of water and starch, and comparatively a very small proportion of fibrin or muscle-making material. Among these vegetables the *potato* takes the foremost rank. It is not only a reliable food for man, sufficient to sustain life exclusive of other diet, but it is also of the utmost value when eaten with animal flesh, as it forms with the latter a congenial combination, from which a sustenance is elaborated that is invigorating to all parts of the animal system—to the respiratory organs as well as to the muscular. And yet the most strenuous efforts have been made by practical men to introduce other vegetables in its place, and to attribute to them the good qualities it

possesses; but they have been eventually compelled to acknowledge their utter inability to supersede it.

The potato (*Solanum tuberosum*) is found growing wild in Chili and the islands to the south, about 45° south latitude, but never more than a few miles inland. This species, however, is widely different from the cultivated potato, the tubers being small and the flowers a pure white, and without the bluish tinge common in those of the latter. The younger HOOKER has discovered in that region five varieties of the wild potato. Other varieties are found in the East and West-Indies, and are known as the *Solanum commersonii*, POIR., the *S. maglia*, DUN., and the *S. immite*, DUN. In Mexico, too, grow the *Solanum demissum*, LIND., the *S. cardiophyllum*, LIND., and the *S. verrucosum*, SCHLECHT; the latter of which is said to produce small but palatable tubers, that are eaten by the foreign population of the country. All these varieties, however, unlike those of Chili, grow inland as well as in the neighborhood of the coast, and on both elevated and low ground.

The history of the early discovery of the potato is somewhat obscure, but eminent naturalists generally admit that it is an indigenous plant of America, and was transported from the Carolinas to England in the year 1586; after which it was disseminated over Europe. Comparatively little notice was taken of it before the beginning of the present century, when it excited a great amount of interest from the extraordinary dependence that it was found could be placed upon it as an article of food.

The potato is now cultivated as far north as Bergen

in Norway; but it only arrives at its greatest perfection in the temperate zones, where it has been known, under extraordinary cultivation, to produce over seven hundred bushels to the acre.* That proper culture has improved its quality is evident from the estimation in which it was held at the beginning of the eighteenth century. In MORTIMER'S "Gardener's Kalender" for 1708, it is directed that the potato be planted in February (that is, in England) and as indicative that its character had not then become generally known, it is remarked that "the root is very near the nature of the Jerusalem artichoke, although not so good and wholesome, but it may prove good for swine."

At the present day it has arrived at the height of its perfection. It has, however, changed so much from its original nature, and the equilibrium of its organic relation has become so disturbed, that it now exhibits a tendency to decay; and scientific naturalists have, in consequence thereof, intimated the necessity of introducing the cultivation of the original wild potato, which it may require many years to bring to any thing like a state of perfection. Still, in the present state of art and scientific skill, the desired object may be accomplished after a few years' cultivation, notwithstanding that the attempts which have already been made to cultivate the wild plant have been attended with but partial success. This is much to be regretted; but in addition to experience, time is required to accomplish success, and this is especially well

* London Horticultural Society's Transactions for March 19th, 1833. Paper read by Andrew Knight, President of the Society.

known to practical cultivators of vegetables and fruits, who have discovered that a continued series of like treatment often produces peculiar and favorable results.

The peach grown in China has also changed, having now the pit on one side of the fruit, which it is not to be supposed was its original formation, but is rather the result of centuries of cultivation. From the economical method there adopted of training the trees against the wall, land being so very valuable, the pulp, in the course of time, has gradually increased in development toward the light; for all plants have a natural tendency to grow toward the sun, their forms being equalized only when all parts are fully exposed to its influence.

Change of locality affects the potato very much and improves its quality. The very prolific and common red potatoes, which, with us, are so rancid as to be only grown for the purpose of feeding stock, are sent to the Bermuda Islands as seed, and from this seed most delicious potatoes for the table are produced and returned to our markets.

This and other most cogent reasons should induce perseverance in the cultivation of the original potato for a succession of seasons, in order to determine if it is possible to renew a healthy variety from the wild tuber.

Though it is universally admitted that the potato is a most valuable adjuvant in the food of man, it must be conceded that it is not appreciated to its full value. Its congenial qualities are indicated by the robust health which is enjoyed by persons who make it their principal diet, and who are usually exempt from the

various ailments that affect those who make the cerealia and animal flesh their chief food. The latter are subject to decaying of the teeth, mostly caused by defective digestion and the consequent acidity of the stomach; while their secretions are morbidly affected, and produce ichorous humors which create excessive itching in local parts, as well as roughness, blotches, and pimples on the skin. These derangements are but seldom if ever found upon persons who make the potato their leading diet.

These morbid secretions result from the impairment of the digestive functions induced by the stomach being overloaded with highly nutritious food; and this overloading is almost unavoidable when wheat-bread and meat are made the chief diet, because the proper or required amount of nutriment is contained in so small a quantity of such food that the appetite is not satisfied with it, and an excess is generally taken, and produces heaviness and an inclination to sleep, which are direct indications of a superabundance of nutriment. In such an event rest is essential in order that, by a concentration of the vital forces, the stomach may be relieved of its burden. Even then the food will not be properly digested; but the relief obtained will render the person temporarily unconscious of the injury his system has sustained, for the effects of his over-indulgence will not be immediately felt, but will be obscured, and, when he does become sensible to them, will most likely be attributed to any thing but the true cause. And so biliousness will be attributed to a bilious temperament, and violent headaches to a constitutional nervous

derangement or to over-exertion; while no attempt will be made to account for flatulency and eructations, which will be only noticed for their inconvenience; but they are the direct indications of an overburdened stomach, which has yielded to the fermentative process and eliminated gas that never results from the digestive functions when properly operating.

This action illustrates statements made in a previous chapter: that gluten or fibrin, of which wheat contains the greatest amount, is the active ingredient in fermentation, and that the final result of fermentation is acetic acid; however, when fermentation is produced in the stomach, it is not always that acid, but sometimes other acids that are engendered. When the fermentative process takes place in the stomach, the digestive powers become so enfeebled that they are unable to act upon fats, such as butter, rich sauces, gravies, fat meats, etc., and leave them to become exceedingly acrid from chemical changes. The fermentation being active, regurgitation ensues and excoriates the throat, and this is soon followed by sick headaches and such other ailments as neuralgia, rheumatism, etc., which are often attended with depression of spirits and foreboding of evil. These are the maladies which follow the eating of excessive quantities of very nutritious food, or, more properly speaking, of food containing the greatest amount of nitrogenous substances—albumen, fibrin, and casein—which can only be expended in severe exercise; and such exercise is only effective when the system has become accustomed to it.

Muscle, which is the flesh of man or animals, when

fully developed, affords force or strength. One thousand pounds of such flesh contains one hundred and sixty parts of nitrogen, while the same number of pounds of wheat contains but ninety-eight, of potatoes but forty-five, and of corn but about twenty-five. Rice contains but little if any nitrogen. From this comparison we learn that people who lead a sedentary life and do not require to expend muscular force in labor, and who, at the same time, wish to satisfy the appetite with quantity, without impairing the digestive powers, will find that potatoes will not only meet their requirement, but will allow of their eating with them a moderate quantity of lean meat, or fresh butter, to which may be added a limited portion of wheat loaf-bread that has been carefully fermented, and that, when soaked in water, will not change, or. will only produce a slight change, in the color of litmus paper. Persons who freely secrete perspirable matter of an oleaginous character, and who actually secrete nitrogen in the form of ammonia, in combination with other secretions, can indulge with impunity in a tolerable amount of meat, and in reality require such a diet.

Persons of enfeebled digestive powers will not only be able to digest potatoes, but they will find them to be a preventive to the forming of those acrid compounds that so frequently cause distress when fats are taken without a suitable quantity of farinaceous food to diffuse them. Maize or corn-bread usually disagrees with this class of persons, as maize contains oil, and is therefore an unsuitable diet for them. Of all the cerealia, rice most resists the fermentative pro-

cess; consequently, when it is well boiled, and is eaten with tender lean meat, broiled quickly and left quite rare, it forms the most suitable article of food for persons having enfeebled digestive powers. It will not only suffice to satisfy the requirements of quantity, but it will diffuse the meat if the latter is well masticated, and will thus prevent it from becoming oppressive. The food will then be properly digested, and will eventually afford nutriment sufficient to invigorate the enfeebled organs, so that they will be enabled to perform their wonted functions without difficulty.

Dr. Harkins, in his "Medical Statistics," states, upon the authority of M. Villerme, that of the children born in the department of Indre, a locality in France possessing a very fine dry climate and a temperate people, one fourth die within the first year, one half of those left between their fifteenth and twentieth years, and three fourths of the remainder before they reach their fiftieth year. A very eminent physiologist, M. Dutrochet, a resident in that department, attributes the cause of this extraordinary mortality to the food, which consists chiefly of bread, of which he calculates every adult person eats two pounds a day; and he is of opinion that, if a portion of potatoes and a small quantity of animal food were substituted for it, the people would both live longer and enjoy better health. But to the introduction of this desirable change two almost insurmountable difficulties have been found to stand in the way—meat can not be had, and a strong prejudice exists against the eating of potatoes. With us, however, no such

obstacles to the adoption of a healthy diet need be anticipated, nor any other short of a failure of the potato crop; and the fear of this has led to a special inquiry into the subject, which has resulted in the threatened calamity being averted by the partial success that has attended the introduction of new varieties of fair quality, which afford a liberal yield, and, when carefully gathered and protected, remain exempt from disease. At the present time there is a sufficient supply of this esculent in the country to meet even one half of the whole amount of food required for the inhabitants; and if potatoes were used to that extent, it would be most advantageous to the people, not only in a pecuniary sense, but in the improvement of health, and particularly the health of those who reside in densely populated cities.

The stomachs of children are much impaired by the common practice of giving them large quantities of fluid diet, beyond which it induces a craving for a large amount of food, which continues through life. Such a condition is, in fact, that of most of our people, and it is entirely attributable to the cause here stated. Under these circumstances, as quantity and not quality is required to satisfy the appetite, potatoes and rice, or esculents which do not contain a large amount of nutriment, should be eaten in preference to much wheat-bread and meat, or other analogous diet. The very pernicious habit of giving large quantities of milk, milk-porridge, or other fluid diet to children should, most especially, be carefully avoided. One fourth the quantity usually given would be ample sustenance for a child, and would be far

more conducive to its health. The benefit would be apparent in after life, as then the craving to which we here allude would not exist, and there would be no desire to overburden the stomach with food, which, when taken, is frequently of too nutritious a quality, and consequently most injurious.

The value of esculents as a diet can scarcely be over-estimated; for, when used to dilute the very nutritious food that is indulged in by all who can obtain it, they are very beneficial to health. As they vary but little in their nutritive qualities, the reader would derive little advantage from being presented with a description of the very many varieties that are now cultivated, or with the history of those that have been cultivated from the earliest ages.

The comparative value of the common articles of diet, in so far as relates to the most important constituent of food, namely, nitrogenous matter, or protein, (the properties of which we have already very fully described,) is very plainly illustrated by Dr. Lyon Playfair in the following table, which he presented in a course of lectures delivered before the Royal Agricultural Society of Great Britain:

100	pounds	of	turnips	contain	one	pound	of	protein.
50	"	"	potatoes	"	"	"	"	"
50	"	"	carrots	"	"	"	"	"
25	"	"	milk	"	"	"	"	"
9	"	"	oat-meal	"	"	"	"	"
7½	"	"	wheat-flour	"	"	"	"	"
4	"	"	lean flesh	"	"	"	"	"
3½	"	"	peas or beans	"	"	"	"	"

From this table it will be perceived that potatoes and carrots contain double the protein or nitrogenous

matter found in turnips, but only half of that contained in milk, rather more than one seventh of that found in wheat-flour, and a little less than one twelfth of that contained in lean meat.

CHAPTER II.

PLANTS OF WHICH WE EAT THE LEAVES, ETC.

Value of esculents as food—Have been used for diet in all ages—Asparagus cultivated to perfection by the Romans—Cabbage most digestible in a raw state—Kohlsalat and sauerkraut—The lettuce much prized by the Persians—It is a wholesome diet when eaten with dressing—Vinegar is a promoter of digestion—Oil arrests fermentation in the digestive organs—By whom sugar should not be used in dressing—Remarks apply equally to the dressing of all salads—Celery a most valuable salad-plant—In its wild state is rank and unpalatable, but when cultivated is sweet and agreeable—Is a great promoter of digestion—Parsley of the same family as celery.

THOSE plants of which we eat the leaves, flowers, and young shoots—such as cabbage, spinach, asparagus, etc.—contain, with water and starch, only a small amount of protein in the form of albumen; but not a sufficient quantity of it to render them an efficient diet for man. Yet they are exceedingly beneficial to health when eaten with the more nutritious kinds of food, and particularly in the spring and summer seasons, when, indeed, they ought to be used almost to the exclusion of highly nutritious articles of diet. It is evident that their good qualities in this

respect have been long apparent, for they have for ages been universally eaten by man, notwithstanding that they are so insipid to the taste as to require dressings to make them palatable.

Cabbage (*Brassica oleracea*) was in cultivation by the Romans in the days of Columella, who states that it was a favorite edible with freemen, and in sufficient plenty to be an article of food for slaves. The ancient Germans also cultivated cabbage from very remote times, and were indebted to the Romans for its introduction. *Spinach*, (*Spinacia oleracea*,) according to Beckman, was used as an edible substance in Europe in the year 1351, (having been previously used as a medicine.) *Asparagus* (*Asparagus officinalis*) is one of the most ancient known of culinary vegetables, and has ever been esteemed as a great luxury. It was held in much favor by the Greeks, and is described by Dioscorides.* The Romans were noted for their skill in its culture, which appears to have far exceeded modern cultivation. Pliny states that three shoots of asparagus grown in Ravenna weighed a pound. This far surpasses any thing we have ever seen; still, the plant being exceeding productive in a rich sandy soil, if only one or two eyes were permitted to grow from a large stool, as it is termed by gardeners, it would be possible to produce such monster shoots, instead of obtaining, as is now usually the case, some twenty or thirty small ones from the same stool or large body of roots.

A large number of esculent plants are eaten in their raw state. Some of these, when cooked, are thereby

* Lib. ii. chap. 151.

rendered much more indigestible than when raw; as, for instance, *cabbage*, which, when dressed as a salad—in which form it is called *kohlsalat*, the cabbage salad of the Germans—is easy of digestion, and can be eaten by those who can not partake of boiled cabbage without injury. *Sauerkraut*, the sour cabbage of the Germans—a preparation of raw cabbage made by a process of fermentation, in which it generates the vinegar that pickles it—is also a most wholesome diet, and was formerly in great demand by persons taking long voyages at sea, owing to its being considered a preventive of that deplorable scourge known as the scurvy. It is, however, in consequence of its bulk, not now in much requisition for that purpose, having given place to lemon-juice, which is equally efficacious in preventing and arresting that disease, and possesses the advantage of requiring much less room on board a ship, where economy of space is ever an important consideration.

The *lettuce* is one of the most universally cultivated esculents now known, and consists of two varieties, the *Lactuca capitata*, or heading lettuce, and the *Lactuca crispa*, or curled-leaved. These varieties were cultivated by the ancient Greeks, and were known to the Persians in the time of CAMBYSES, and with the latter form to this day one of their most prized dishes. The common people eat the plant raw with olives, bread, and cheese.

Lettuce is generally considered a most wholesome diet, as it usually agrees with very delicate persons; but this may be partly attributed to the dressing, as it is generally eaten with a preparation made of oil and

vinegar. Vinegar, if taken in due proportion and not in excess, promotes digestion, and assists the digestive organs when very indigestible articles of food have been eaten, relieving those organs from the effect of an indiscretion which might prove most serious, if it were omitted. Oil arrests fermentation, to which there is a tendency in enfeebled digestive powers, and by thus preventing the process, allows sufficient time for the accomplishment of proper digestion. The oil itself, however, is not readily digested; but it is inoffensive to the stomach when pure and not rancid. Sugar is often used as a part of the dressing, but should not be indulged in by persons with weak digestive powers, as it is a promoter of fermentation, which, we repeat, terminates in the formation of acid in the stomach, to the interruption of healthy digestion.

These remarks apply equally to the dressing and eating of salads, made from the various kinds of esculent plants, with the exception of celery, which, when well blanched, may be eaten raw and without dressing. In this state it is a promoter of digestion, which quality it possesses in an eminent degree.

Celery (*Apium graveolens*) is one of our most valuable salad plants, and is a remarkable instance of the effects of cultivation. In its wild state, it is rank, coarse, and unpalatable; but when properly cultivated and blanched, it is sweet, and of a very agreeable flavor to most persons accustomed to use it. The Italians do not blanch the plant, but use the leaves and seeds as ingredients in their soup, and consider them great promoters of digestion. *Parsley* (*Apium petroselinum*) is of the same family as celery, and is

supposed to be very wholesome. The celery plant is the production of a saline soil. It is found on the coasts of the Mediterranean, in Greece, Turkey, and in some of the salt marshes of this country; it is the favorite food of the canvas-back duck, and is supposed to conduce to the fine flavor of that much admired game. It is of ancient notoriety, having been adverted to by THEOPHRASTUS, the Grecian philosopher.

CHAPTER III.

FRUITS, THEIR PROPERTIES AND QUALITIES.

Fruit desirable as an adjuvant in diet—Promotes digestion, and lessons the demand for hearty food—All fruits are not deficient in nutriment—Their medicinal properties—They contain organic acids—Table of gases found in these acids—They are appropriated to the uses of the body—The fruits in which specific acids are found.

WITH respect to fruits, we shall now confine our remarks to their peculiar qualities. In a previous chapter, in treating of the cellular substances, we compared with their properties those of fruit, and there entertained the opinion that salads serve the purpose of lessening the demand for more hearty food, and are most desirable as an adjuvant in diet in early spring, and until the summer fruits ripen, and are placed in the dietary catalogue. The remarks are equally applicable to both products as necessary food for man, for they are al.ke very conducive to health at all seasons, but more especially in our climate in

the summer and autumnal months. As the cold season approaches, more hearty food is necessary to sustain the demand of the body for increase of animal heat, and vegetables and fruits are then only required in less quantity, and as promoters of digestion.

As we have thus represented fruits as useful in lessening the demand for more nutritious diet, and as contributors of a medicinal property or promoters of digestion, the impression might be entertained that all fruits are deficient in nutriment. Such, however, is not the case. Some fruits are quite as nutritious as the potato, if not more so, especially tropical fruits. But it is the other most valuable properties which they possess that are most requisite in this climate, which induces a demand for a change of diet in accordance with the change of season, in order to maintain a tolerable standard of good health. These properties are the acids, the volatile oils, and the alkalies, which, though they do not contribute to the increase of the growth of muscle, are essential to sustaining animal life. The acids are termed "organic," and abound not only in fruits, but in most vegetables that are eaten by man, while in a succulent form. To those vegetables that are deficient in them, he almost invariably adds, or has a desire to add, vinegar.

The acids obtained from fruits and vegetables are the malic, tartaric, citric, and oxalic. The following table exhibits their compounds of the elemental gases:

			Carbon.	Hydrogen.	Oxygen.
Apples	contain	Malic Acid,............	8	4	8
Grapes	"	Tartaric "	8	4	10
Lemons	"	Citric "	12	5	11
Rhubarb	"	Oxalic "	2	0	8

These acids are generally supposed to be appropriated to the uses of the body, other than for the evolution of heat, which results from the partaking of starch, oil, and sugar.

Malic acid is found in more or less quantities in the *pomaceous* family of plants, to which belong the apple, pear, quince, medlar, and others.

The stone-fruits, or those that have hardened endocarps, contain tartaric and malic acids in their pulp, and prussic or hydrocyanic acid in their seed proper.

CHAPTER IV.

THE APPLE AND THE PEAR.

The apple the most valuable fruit—The prophet Joel refers to it—It is also mentioned by Shakespeare—Manufacture of cider favored by Charles I.—The consequences of partaking of impure wines—Wild apples and pears, where found—The pear has a much wider range than the apple—The cultivation of apples and pears most improved by the Romans—The varieties mentioned by ancient writers—Their number at the present day—A knowledge of good fruit not encouraged in the United States—Unripe fruit pernicious even when cooked.

THE APPLE (*Pyrus malus*) must be placed at the head of all the fruits on account of its many good qualities; for it is not only ve y refreshing and palatable, but it possesses in its numerous varieties the most diverse and delicious flavors. Probably it is not so exquisite in taste as some of our very tender fruits, but still in this respect it will bear

a fair comparison with them; while it certainly far surpasses all in affording us its advantages throughout the year, and in great extremes of climate. It is said to grow wherever oaks thrive.*

The history of the apple dates from very early ages. We find it spoken of by the prophet JOEL, who remarks that "the vine is dried up, and the fig-tree languisheth; the pomegranate-tree, the palm-tree also, and the apple, even all the trees of the field, are withered."† SHAKESPEARE repeatedly mentions it, and in a sentence in the second part of "Henry the Fourth" indicates that its cultivation was pursued in his day. In that play he makes Shallow say, "Nay, you shall see mine orchard, where in an arbor we will eat a last year's pippin of my own graffing, with a dish of caraways, and so forth."

At the present time the many varieties represent, more or less, the flavor of almost every delicious fruit; and, in the shape of cider, afford us a most refreshing beverage, that, when properly manufactured, quite equals some varieties of wine, and excels others, in its wholesome qualities. The planting of orchards for the manufacture of cider was favored by CHARLES I. of England, so that its use might supersede that of wine, which was imported from France. But wine had then obtained such a position among the opulent that with them it was found impossible to supplant it with a beverage that could be so easily procured by the common people. And this is the principal reason that cider is not now in more general use in the United States, instead of the miserable and un-

* Von Bush's Travels, p. 40.

† Joel 1 : 12.

pleasant flavored wines that are either imported or prepared at home, and are drank at our tables, though they are quite disagreeable to the palate without the addition of sugar and ice. These additions, however, have not the least tendency to modify the well-known consequences of an indulgence in such fluids—gout, rheumatism, or neuralgia in all its various phases.

The wild apple and pear are found in all temperate climates. We have a native apple in the United States, called the *Pyrus coronaria*, or American crab-apple. In the forests of Europe, and in the Caucasus, are found the *P. malus*, or common apple, and the *P. communis*, or common pear, being indigenous to those regions. In Balkair, in Hindostan, the pear-tree grows in large groves, while the apple-tree is more solitary in its habit. Both these wild species produce small, ascerb, bitter fruit.

The *pear* (*Pyrus communis*, LINN.) is said to have a much wider distribution than the apple. The gardens of the Phœnicians and of Thasos were celebrated in ancient times on account of the excellent pears they contained. The ancient Romans were noted for having most improved the cultivation of both pears and apples, and some of the varieties they grew are known at the present day.

The progress of cultivation in the production of various kinds of pears and apples has been very considerable, but a great number of years have been required to produce them. THEOPHRASTUS enumerates three kinds of pears and two of apples, and CATO six kinds of pears and seven of apples; while PLINY knew of forty-one kinds of pears and thirty-six of apples, and

PALLADIUS of fifty-six kinds of pears and thirty-seven of apples. At the present day the varieties of both may be numbered by hundreds; but many of them are neither very distinct in character nor inviting to the palate. It is to be regretted that the names of only a very limited number of the finest varieties are known to either the rich or the poor in this country, where a perfect knowledge of the various species is solely confined to cultivators, which may be attributed to our horticultural and pomological societies being unsustained in their efforts to inculcate an acquaintance with the choice fruits, and to the neglect of the people to avail themselves of their labors. It is through such sources alone that the people can become acquainted with them, and acquire a knowledge of the essentials requisite to produce fruit of the best varieties, and in perfection. As it is, the markets are generally supplied with inferior flavored qualities, which are obtained from the producers at very moderate prices, and which, when not fully ripe, possess to the latter the advantage of being able to preserve a fine appearance for a greater length of time than the finer qualities would.

The consequence of all this is, that gross impositions are constantly being practiced, and that the people have palmed upon them apples and pears which should be condemned as pernicious, because of the effects that are produced by eating unripe fruit, or fruit which has ripened during warm weather in the barrels or baskets of some huckster. And this is the more to be regretted when we consider that there is nothing more grateful and salutary to the sick, even in an at-

tack of irritation of the stomach and bowels, than good ripe apples or pears taken direct from the trees, pared and cored, and eaten in moderate quantity. But the granulated portion about the core of the pear, of which some varieties have more than others, should be carefully avoided by persons having weak digestive powers or an irritable condition of the stomach or bowels. And, above all, fruit should not be eaten that has been kept in a confined room where there is decaying vegetable matter, or that, during the warm summer months, has been exposed to an impure atmosphere for over forty-eight hours, as after such exposure it can not be eaten with impunity by either adults or children. The eating of all unripe fruit should be carefully avoided, it matters not whether it is raw or cooked; for, as we have heretofore explained, cooking only very slightly modifies the acids that are contained in it; and these acids are not only very different from those found in ripe fruit, but are decidedly injurious to the digestive organs. These remarks apply equally to all kinds of fi uit.

CHAPTER V.

STONE-FRUITS, THE GRAPE, ETC

Stone-fruits are divided into two families—The seed, bark, and leaves contain hydrocyanic acid—The peach a wholesome fruit—The cherry and the plum not so wholesome—Want of disposition in many to cultivate fruit-trees—The noble-hearted traveler Burchell—The misfortunes of Sickler, the German horticulturist—The peach cultivated in the earliest ages—It is mentioned in the books of Confucius—The original home of the cherry—The grape one of the first fruits cultivated by man—Is indigenous to several countries—Varieties produced by crossing—American grapes—The properties of the smaller fruits identical with those described.

THE stone-fruits, or *Amygdaleæ*, are divided into two families of plants. The peach, nectarine, and almond form one; and the apricot, plum, and cherry the other. They all exude gum, and their seed, bark, and leaves contain hydrocyanic acid. This very poisonous acid, however, has not any tendency to impair the good qualities of the fruit.

The *peach* (*Amygdalus Persica*) is a most wholesome fruit to all persons who do not possess a very direct tendency to acidity in the stomach, and even to those who do the effect it produces is only felt for a very limited time, and is then usually followed by the beneficial result of exciting the bowels to action—for acidity of the stomach is generally attended with constipation of the bowels.

The *cherry* (*Prunus cerasus*, LINN.) and the *plum* (*P. domestica*) are much more decided in their action on the bowels, and can not be indulged in by many persons. This most probably results from the common practice of swallowing the indigestible skins, as well as from the laxative effects of the tartaric acid contained in the pulp.

All these fruits, so delicious and grateful to the sight and taste of civilized man, have been carried by him in his migration, and have been carefully cultivated wherever the climate would permit. All persons, however, do not possess the disposition to provide even for themselves, much less for posterity. Even among us are to be found those who think it a long time for fruit-trees to grow, and, as they therefore conclude that they can not be much benefited by their produce, consequently do not think it worth while to plant them. But there are always some among men whose minds rise above this petty selfishness, even when they can not foreshadow a prospect of self-benefit. Of such was the noble-hearted traveler BURCHELL, who, when journeying in the interior of Southern Africa, presented to the chief of the Bachafins tribe a bag of peach-stones that had cost him much care, and most probably had much inconvenienced him in his long journey. "Nor did I fail," remarks the benevolent man, "to impress on his mind a just idea of their value and nature, by telling him that they would produce trees which would continue every year to yield, without further trouble, abundance of large fruit of a more agreeable flavor than any which grew in the country of the Bacha-

fins." Says HUMBOLDT: "Why have not everywhere the names of those been preserved who, in place of ravaging the earth, have enriched it with plants useful to the human race?" For ages after their day must the admiration of all liberal-minded men be felt and expressed for such public benefactors, of whom there are many names on record.

The Transactions of the London Horticultural Society contain a most interesting memoir of SICKLER, a distinguished naturalist of Germany, who paid particular attention to the cultivation of fruit-trees in the Duchy of Saxe-Gotha, and formed for the purpose three nurseries. The first of these, containing eight thousand grafted trees, was, in 1806, entirely destroyed by the French, after the battle of Jena, when NEY's corps bivouacked in it. And again, after the battle of Leipsic, in 1814, the second nursery planted by the same eminent man was destroyed by the Cossacks. Yet, in 1817, he had planted and reared a third with his own hand, persevering in his good work for the benefit of after generations, who should reverence his name with thankfulness when they taste of the fruits of his perseverance and labor.

The history of the cultivation of the *peach* goes back to the furthest antiquity. This fruit is believed to be the *Tao* mentioned in the books of CONFUCIUS, who flourished in the sixth century before the Christian era, and it is said to be still grown to the greatest perfection in China and Japan.

The species of *plums* includes the common cherry (*P. cerasus*, LINN.) and the black cherry, (*P. avium*, LINN.) The former of these was found growing wild

in the mountain forests of Southern Caucasus, and was brought to Italy from Cerasunt, in Pontus, after the conquest of MITHRIDATES, seventy-four years before the Christian era.

The *grape* (*Vitis vinifera*, LINN.) must be considered one of the first fruits cultivated by man. It is indigenous to several countries, and, like the cherry, is said to have an origin in the southern part of the Caucasian mountain chain, where it is found growing wild, bearing an inferior-flavored fruit of small size. But the constant change of circumstances has, in the course of ages and under skillful culture, resulted in so changing the nature of the plant that it now produces the most delicious fruit we are enabled to enjoy. There are many varieties of grapes that have been produced by intermingling, or crossing, as it is termed by horticulturists; and the intermingling of other grapes with those that are indigenous to this country has had the effect of increasing the number of varieties cultivated by us.

From the *Northern Fox grape* (*V. labrusca*, LINN.) has been produced the well known *Isabella grape*, which possesses the most valuable qualities of bearing a fine-flavored fruit, and of growing in the most confined situations, even in city yards, and of producing, under such unfavorable circumstances, an abundant crop. It may be truly called the poor man's friend; for it is often found trained up the end of some of the most humble cottages, and loaded with luscious fruit, which supplies the occupants for weeks with a wholesome, delicious dessert, that their scanty incomes would not permit them to purchase.

We have five other varieties of native grapes, some of them much prized for their good qualities. The *Muscatine* or *Southern Fox grape* (*V. vulpina*, LINN.) has a fine musk flavor, and from it has resulted the *Scuppernong grape*, which produces an excellent wine of most peculiar taste. The *Catawba grape*, a delicious fruit, is also the result of some of the Southern varieties. It is a fine table fruit, grows most vigorously in the Middle States, and, in Ohio, is used almost exclusively for making the finer qualities of wine. The *Winter grape* (*V. cordifolia*, MICH.) is very tart, but, when preserved in sugar, is much prized for the table. The *V. æstivalis*, MICH., is a small black grape, possessing a most pleasant flavor and ripening in October. The other two native varieties are the *V. bipinnata*, TORR. and GRAY, found growing in Virginia and Kentucky, and the *V. indivisa*, WILDD., found on the banks of small streams in Ohio and Western Virginia.

From these native varieties, grown in different localities, and from the grapes of foreign countries, new varieties are being produced, of almost endless peculiar qualities, and are being brought into the market with distinguishing names.

The numerous small fruits eaten in their season are equally interesting in both their properties and history with those briefly noticed in the preceding pages; but to describe even their properties would occupy more space than we can afford. The omission, however, is of little matter, as the relation would merely be a repetition of what we have already stated,—their properties as well as those of the grape being, in fact, identical with those of the other fruits described.

PART VII.

BEVERAGES AND CONDIMENTS.

CHAPTER I.

WATER AND STIMULANT DRINKS.

Fluids essential to life—They are injurious when not dissipated from the body, and when taken to excess—Much evaporation dissipates animal heat, which is essential to health—The digestive functions impaired by fluids—Water the most salutary drink—It prolongs life when nutriment can not be obtained—Instance of a man who lived fifty-three days on water alone—Water very beneficial to robust persons—Pernicious effects of alcoholic drinks—Constant excitement exhausts the system—The propriety of giving stimulants to aged and infirm persons doubtful—Alcoholic drink as a medicine serves an invaluable purpose.

FLUIDS are essential to the sustenance of the animal system, and the demand for them, especially when they are unattainable, is even more imperious than that for solid food. The whole system permits their percolation from the internal to the external surface, where they are either dissipated or accumulated within the external integuments in the form of dropsy. In a healthy condition of the system a large amount is thrown off with the excrementitious fluids and semi-solids; and in direct ratio to the expenditure ought the demand to be supplied to maintain a healthy standard; special care, however, being taken not to indulge in drinking an excessive quantity of fluid of any kind, either of com-

pounds or of water alone. It is true the system generally relieves itself of fluids much more readily than of solids; but it must be borne in mind that, when it is overtaxed in this respect, an unnatural condition is induced, because the evaporation of fluids from the body deprives it of its animal heat, which is essential to the maintenance of the vital forces. Excessive secretion, too, on account of the general debility it occasions, predisposes the system to disease of a most serious character, and, if the secretion is obstructed, dropsy is the result. Food is impaired in its nutritious qualities if it is largely diluted when taken into the stomach, or if it is diluted during eating; for in such cases the excess of fluid has first to be absorbed, and the whole has to be reduced to a semi-solid mass before digestion properly ensues. And it can not be doubted that a large portion of gastric juice is thus carried off with the fluids, and the stomach is thereby deprived of part of its wonted means to digest food. The gastric juice, however, coagulates milk taken direct from the breast, as in the case of the nursing babe; and, as such milk is not acid, the process is a healthy one, for it prepares the food for digestion by first causing the fluid to be absorbed. It is the curd so formed without acid that supplies the increase or growth in the young that feed on milk. If the milk, when thrown off, proves to be acid, it is evident that either the child's stomach has been overburdened for some time, and has thus become enfeebled, which is the most probable, or that, from some fault in the health of the mother or of the nurse, the milk is not in a healthy condition.

Water is the most reliable and grateful drink for man. Nature has furnished many admixtures of fluids in the juices of fruit, but none so satisfying to excessive thirst as pure water. It will even prolong life when nutritious food is not taken, as we have a well-known instance on record, reported by Dr. McNaughton in the "Transactions of the Albany Institute, in the State of New-York," for 1836. The case was that of a man who lived upon water alone for fifty-three days. For the first six weeks he walked out every day, and at times spent a great part of the day in the woods. Until about a week before his death he shaved himself, and even on the last day he was able to sit up in bed. It was an instance of voluntary abstinence, resulting from a delusion under which the person labored, and which impelled him to refuse all proper nourishment. The water, which alone he could be induced to partake of, kept the secretions diluted, and the blood in a bland condition until the system was exhausted; and thus his life was prolonged by his being saved from the effect of the concentrated fluids upon the brain, the result of which would have been, in the last stages of starvation, to have produced madness, and to have hastened the termination of life by excessive irritation upon the great nervous centre.

As there is, in all persons blessed with an abundance of vitality and robustness of body, a strong tendency to a concentration and acridity of the fluids, such persons should make water their exclusive drink, in order that they may maintain a normal condition of the system. If any persons can drink large quantities of water with impunity, it is those of full and

plethoric habit, and they would actually prolong their lives by so doing. But instead of this they often, to their injury, indulge in drinking wine, malt liquors, or brandy and like alcoholic drinks diluted with water; or, if water is not drunk directly with the liquor, they will usually drink freely of it immediately after pure spirits are taken, in which case it mitigates the influence of the alcohol in proportion as the latter is diluted. Water thus operates equally in reducing the strength of all stimulating drinks, (for wine and malt liquors contain their own dilution,) and acts as a preventive to their so soon destroying or exhausting the nervous system as they would if taken undiluted; but still their deleterious influence is certain, and is perceptible after death upon certain organs. Let the beverage partaken of be beer, wine, or brandy, by its use such persons shorten the duration of life, and in direct ratio to the constitutional inability of the system to resist its influence. Thin persons often have a redundancy of vital energy, and they are thereby enabled, when indulging to excess, to resist the influence equal to those who have a large development of fat and muscle; while, owing to their secreting powers being generally more active, they can do so even for a longer period of time.

No reflecting and intelligent person will deny that severe and constant excitement exhausts the ability to sustain a long continuance of excitement. Alcohol is a stimulant to the nervous system, and not only excites it to an extraordinary degree, but exhausts the ability it possesses to accumulate power, so that the whole system fails to perform its natural functions if

the stimulant is withheld; for then the hand trembles, the stomach fails to digest, the mind desponds, and a general depression supervenes.* In moderate drinking, as the drinking of beer and ale, a desire for its continuance is very manifest to all who indulge in it. This desire is caused by the nervous system failing to sustain its wonted healthy standard without the assistance of a stimulant. After a time, however, there will be a desire for an increased quantity of such stimulant, and this is a direct indication of the inability of the nerves to endure the preternatural excitement.

Whenever stimulants have to be resorted to for the purpose of relieving a depressed mind, the dejection of which has not been induced by some misfortune or disease, it is evident that the nervous system is seriously impaired by over-stimulating. Persons can habituate themselves to the use of a certain amount of stimulant drink, and of narcotic stimulants, as, for instance, Indian hemp, opium, etc., and still they can with much care guard themselves against any increase, and seemingly sustain no injury from the continuance. But we would ask, Why should they induce a habit that can not be discontinued without their suffering much inconvenience, and can not be continued without their running the risk of being tempted to increase its pernicious influences? Alcoholic drinks, tobacco, opium, chloroform, coffee, and tea, all, when indulged in to satiate a desire, only tend strongly to an increase of quantity without limit, owing to a morbid condition of the system creating a craving for an augmentation

* The withholding of tobacco, after it has been used to excess, induces similar distressing results.

of the pleasurable indulgence which they are presumed to afford.

For aged and infirm persons who labor under an inability to digest ordinary food to their physical advantage, it is strangely urged, even by experienced physicians, that alcoholic stimulants in the form of beer, ale, wine, or brandy are necessary adjuvants. In our opinion such a view requires careful investigation. If the system is exhausted beyond recuperative power, as is the condition of many aged and infirm persons, the effect of administering stimulants will be pleasurable, and will be to afford relief for a very limited time; but then the whole powers of the system will be exhausted by the rapid expenditure of the vital forces, which can thus be only increased for the time to a limited extent, and the dissolution of the system will thereby be hastened. If, however, in place of stimulants, such persons were advised nutritious and easily digested food, exercise, and a proper temperature of the body, so that they might maintain *in statu quo* the small quantity of vital force they possess, their lives might most probably be prolonged, if they were not invigorated to activity of muscular effort, and their health thereby much improved. As persons whose teeth are defective and whose digestive powers are feeble, most commonly desire food which they can not masticate, they drink excessive quantities of such fluids as tea, coffee, and water, and thus dilute the digestive secretions. The most invariable conditions of such persons are a want of disposition to take exercise, and cold feet and chilliness induced by their suffering themselves to be thinly clad; and thus their

circulation is enfeebled, and their demand for food lessened. Stimulant drinks are no substitutes for the deficiencies of the aged and naturally infirm, and must be pernicious in their tendencies when taken by such persons, as they exhaust the vital forces in greater rapidity than the system has ability to generate them.

Alcoholic drink, as a medicament, often serves a most valuable purpose where there is recuperative ability, especially in cases where the system is in a state of torpidity from disease, or is laboring under some extraordinary depressing influence; but it must be administered promptly and carefully. Being a diffusible stimulant, it excites the whole system, and if skillfully prescribed is highly beneficial; but if it is continued after the desired effect is permanently established, injury is sustained by over-stimulation.

CHAPTER II.

EXCESS OF FLUIDS INJURIOUS TO CHILDREN.

Children's health impaired by partaking largely of fluids—Their digestive powers are thereby enfeebled—A cause of cholera-infantum—Proper food for the young—How to keep milk for infants—Regulations to be observed in feeding them.

WE once more repeat, for the purpose of treating the subject more thoroughly, that children are often seriously injured by being allowed to drink excessively of fluids. By such indulgence their digestive powers are enfeebled, and an irritable condition of the

stomach and bowels is induced. It causes them to have enlargement and hardness of the abdomen, and to become irritable and peevish in disposition; and to gratify them they are given any quantity of drink, which is constantly increasing the difficulty. In the summer season, this practice induces cholera-infantum, which is at times curable by simply withholding all drink except a few spoonfuls at a time of weak tea, and not very frequently, and by giving a nutritious diet—that is, fresh meat palatably seasoned with salt, and stale sweet fermented bread toasted and softened with milk. A young child eight or ten months old should be allowed to suck a piece of lean beef, underdone and moderately salted, once or twice a day, if nursing a healthy mother or nurse. If not, it should be supplied, in addition to the meat, with warm milk from a well-fed cow, about a third of a pint at a time. Unless milk can be obtained at all times fresh from the cow, that procured and not used in the morning should be kept through the day in a bottle closely corked, and, when a portion of it is taken out, recorked immediately. Care should be taken to cleanse the bottle every morning with warm water and soda. There should be stated periods for giving the child its food, and an interval of not less than three hours between each period, so that ample time may be allowed for the digestive process: first, for the fluid portion to be absorbed and diffused, and then for the undiluted secretions to act healthfully upon the remaining semi-solid and nutritious portion of the food in the stomach. If the food is given in limited quantity, the more perfect will be the prepared nutriment for the sustenance and

growth of the body. Excess in quantity, like frequency in drinking, partially arrests the digestive process, as it dilutes the secretions essential to the proper digestive action, and tends to a fermentative process. And, as a consequent, we have an accumulation of gases and flatulency, attended with acidity of the contents of the stomach, which produces in the infant griping pains, and most frequently looseness of the bowels, and in the adult much inconvenience. Fluids in quantity have the least injurious effect on the stomach when they are taken one hour before eating, or two hours after; while a moderate portion taken at meal time, with solid food, is not injurious to healthy persons.

CHAPTER III.

PREPARED DRINKS—ICED WATER—ACIDULATED DRINKS —NUTRITIOUS FLUIDS.

Prepared drinks taken for gratification—Their effect on differently constituted persons.—Iced water as a drink—It is sedative and reduces sensibility—Relieves drunkenness—Is hurtful to the mouth, throat, and stomach—Its sedative effects are injurious—Acidulated drinks only salutary to some persons—Nutritious fluids—Soups only suitable for persons of energetic digestive powers—Concentrated juices of meat beneficial.

PREPARED drinks are most frequently taken to induce a sense of gratification, other than the mere satiation of thirst. Hence varieties have been introduced, extolled by some and condemned by others.

This discrepancy usually arises from the impunity with which some persons can indulge in them, while others suffer much inconvenience from even a seemingly moderate use of them. The latter result may be attributable to weak digestive powers, and to the quantity of fluid taken, rather than to the effect of the ingredients from which the beverages are made; and also to the drinks being taken at such unfavorable times that they interfere with the digestive process. To drink immoderately of any prepared beverage, especially if sweetened, and immediately after dinner, causes fermentation, and, if it is taken on a weak stomach, acidity is inevitably the result; but if it is taken some two or three hours before or after dinner, no ill effects will arise, particularly if the beverage is only slightly sweetened and a portion of light food is taken with it. However, confirmed dyspeptics should as much as possible avoid taking drink of any kind at all times, especially when eating nutritious food, and for some hours after.

Iced water, as a drink, has created much discussion in reference to its effects upon the system. To take a rational view of the subject, we must take into consideration the effect that cold, under different circumstances, produces on man. All medical as well as other authorities admit that cold is a sedative. It lessens the activity of the circulation by allaying sensibility, and in proportion to its extent of application and continuance. Consequently it has been used to obviate pain in the performance of surgical operations, in the extraction of teeth, etc. And recently, by means of the iced bath, it has been employed to

allay mental excitement, the result of long-continued drunkenness, and with most decided success.* The effect of cold upon the mouth, throat, and stomach is hurtful. The natural condition of these parts is to be constantly lubricated and rendered moist by a peculiar secretion. They have a sensitive surface, which, when moderately excited, secretes rapidly and makes a most decided demand upon the quantity of fluids in the system, which latter, under ordinary circumstances, meets the demand; but, if the demand is not supplied, the system is notified of the deficiency, and of the supply desired, and this notification constitutes what is known as thirst. Cold being a sedative, consequently a small quantity of cold water will satisfy the thirst, and gratify the desire for moisture. But, unfortunately, we are always desirous of increasing our gratification, and to accomplish this we take more of the cold water than is beneficial for us, and thereby produce a morbid derangement of the delicate membranes that line the parts alluded to. There is an increasing disposition in the economy of the animal system to resist extraordinary influences, if they are not in overwhelming force. The effect ot that force in this instance is to induce an increased sensibility of these tender membranes, which creates a greater craving for cold water; and this is followed by a still further increase of such sensibility, amounting even to a sub-inflammation, when nothing but ice constantly used will satiate the desire for cold, and its use often results in bronchial inflammations, a thickening of the membranes, and a loss of voice.

* American Medical Times, vol. iv. p. 143.

The final result is well known, namely, bronchitis, rheumatism, and enlargement of the glands. Such are some of the effects of taking iced water too frequently, even in small quantities.

There is another most serious result that may be produced by taking large draughts of iced water suddenly upon an empty stomach, or when much exhausted by heat. The sedative effect may be so decided as to entirely arrest sensibility in the coats of the stomach. Such a fatal consequence has been experienced even by those accustomed to indulge in that beverage.

A moderate use of iced water as a drink is, in many instances, of very great advantage to persons of enfeebled digestive powers, as a very small quantity of such fluid will satiate their thirst. In fevers it allays the feverish excitement—in slight cases it obviates the necessity for medicines; while in the treatment of those that are more decided it is a most valuable adjuvant. All that is required to enjoy its delightful gratification is to be moderate in the use of it. If a sensation of cold or a tremulous feeling follows the drinking of iced water, it is the indication that it has an injurious effect upon the system, and then a person ought not to indulge in it again until well satisfied that he is restored to a healthy condition.

Acidulated drinks, which are usually sweetened to make them palatable, and those made from sweet juices, are not only grateful but salutary to some persons, and, under peculiar circumstances, are quite desirable. But to those predisposed to acidity of the stomach they are decidedly pernicious, and should

never be indulged in by them. And here again we must remark that quantity may prove injurious even to those persons who may be benefited by a moderate indulgence in these drinks.

The same objection, with reference to the partaking of quantity, also holds good with regard to those fluids which are usually considered nutritious. Soups, though variously made, mostly contain the juices of meat; but, in order to judge of their suitableness for digestion, and to determine the actual amount of nutriment they possess, we must ascertain the proportion of fluid they contain. As the fluids have first to be absorbed before digestion takes place, and as the digestive secretions are diluted and absorbed with them, the amount of fluid will decide whether there will remain a sufficiency of these wonted secretions to digest the nutritious matter, and, in addition, the amount of solid food that can be advantageously taken after the soup has been properly digested.

Persons of energetic animal powers, who are accustomed to eating soups, are not generally injured by them if they are taken in moderation. But delicate persons can not eat them with impunity, for they usually become acid in the stomach, from its want of ability to dispose of the excessive quantity of fluid and to digest the remainder, and the result which ensues is fermentation instead of digestion.

The concentrated juices of meat are admissible in small quantities, and are of great value when properly taken by the enfeebled sick; but, in order to be beneficial, their use requires the advice of an experienced physician.

CHAPTER IV.

TEA AND THE TEA-PLANT.

Tea, coffee, cocoa, and chocolate form nutritious drinks—They contain a peculiar strengthening power—Dilution impairs their virtue, and is injurious to persons of weak digestive powers—Cream adds to their nutritious qualities—Tea first introduced into Europe by the Dutch—Immense amount now imported into Europe and America—The mode of preparing tea for the market—The different varieties—How to preserve its good qualities—For what it is efficacious—It is an antidote for poison.

MODERN discoveries in the science of chemistry place among the nutritious aliments *tea*, *coffee*, *cocoa*, and *chocolate*, as well as *Paraguay tea*, used by the inhabitants of South-America. All of these are stated to contain a peculiar quality which is strengthening to the animal system, and is denominated *thein*, from its having been first discovered in tea, or *thea*, the name of the plant from which the tea of commerce is obtained. A similar quality afterward discovered to be contained in coffee, and called *caffein*, was subsequently found to be identical with *thein*. The actual character of this substance has been discussed by chemists and physiologists, and it has been a subject of doubt whether it really affords nutritious matter, or, like *quinine*, which is obtained from bark, it is merely an excitant of tone to the sys-

tem. Be this as it may, it is a very remarkable fact that the use of those articles in which it is found is almost universal, and the beverages they produce are not only drank by man, but are approved of as being most agreeable to his palate. And from this fact some are induced to believe that it must have been their nutritious character that led to their introduction and has sustained their extraordinary reputation. That the beverages possess most refreshing qualities is undeniable; and as these qualities are proportionate to their concentration, it is evident that an excessive quantity of water lessens their favorable tendencies. The superabundance of fluid has an injurious effect on a weak stomach, and more especially in consequence of the beverages being sweetened, for they are thus rendered more liable to become acid.

Rich milk or cream adds greatly to their nutritious quality, if they are not too much diluted with water. The greatest amount of injury sustained from the drinking of them is most probably due to a superabundance of fluid and the sweetening, unless it be to the idiosyncrasy or peculiarity of a person rendering him unable to tolerate one or other of the beverages, which is, after all, a matter of but rare occurrence.

Tea was first introduced into Europe by the Dutch East-India Company, in the early part of the seventeenth century. A small quantity was sent, in 1666, from Holland to Lords Arlington and Ossory, of England; and, in 1678, 4713 pounds were imported into the latter country, and constituted about the commencement of the tea trade. At the present time con-

siderably over 100,000,000 pounds are annually exported from China to Europe and America. In the season 1851–2, there were exported 65,100,000 pounds to Great Britain; 34,327,000 to the United States; 8,829,000 to Australia; 3,000,000 to Holland; 500,000 to India; and 2,200,000 to other countries—making a total of 113,956,000 pounds; while at the same time the exports overland to Russia amounted to about 15,000,000 pounds a year. The rapid increase in the consumption of this commodity will be apparent when we state that exactly thirty years before, in the season 1821–2, the amount imported into Great Britain was only 28,787,600, and into the United States, only 9,312,267 pounds. In the fiscal year ending June 30th, 1866, we imported 42,978,576 pounds, valued at $11,116,623, of which 30,199,000 pounds came direct from China, and 6,585,500 from Japan. And yet it is stated that, if Europe and America were to cease purchasing tea, the trade would not be materially affected in China, so great is the home consumption.

The *Thea viridis* and *Thea bohea* are the plants from which the varieties of tea are gathered. Those plants are indigenous to China and Japan, where their leaves have been used for making the beverage from time immemorial; and, from the days of Confucius, tea has been the constant theme of the poets of the Flowery Land. Though tea is more or less cultivated for local consumption in all the provinces of China, that which is exported is grown in a part of the empire distinguished as the "tea-country," and situated between 25° and 32° north latitude, and 115° and 122° east

longitude. The *green tea* district is about seven hundred miles from Canton, and the *black tea* district about four hundred miles from that city. Both varieties are conveyed to the sea-ports by land carriage, chiefly by porters, and by the canals.

There are but few species of the *Thea*, which is of the same genera as the *Camellia*. The *Thea viridis* is said to be a much stronger growing plant than the *Thea bohea*. It flowers earlier in the season, and bears much larger leaves, those of healthy plants being from three to four inches long. Both plants may be found growing in many of our conservatories to great perfection. The first-named variety is supposed to furnish the leaves for the preparation of *green tea*. The smaller leaves of the *Thea bohea* are more numerous on the plant, and of a darker green, and, most curious to relate, are cured and known as *black tea*.

Much special care is taken by the Chinese, in the gathering of the leaves, to preserve them from injury or taint. Collectors are trained for the purpose at an early age; and, for weeks before the harvest commences, they are prohibited from eating fish, or any other food of strong odor. They are also obliged to take a bath two or three times a day, and, when gathering, are not allowed to touch the leaves with the naked fingers.

It is stated that the finest quality of leaves for making tea is often seriously injured by the delay of one night after they are ready to pluck, and thus the necessity for their being promptly gathered. Great care is observed to prevent noxious weeds from grow-

ing among the plants, as they are supposed to be injurious to the leaves. The finest qualities are obtained from plants about three or four years old: by the time the trees have arrived at the age of six years, the produce has depreciated in quality, and they are then removed for a young plantation which is grown from seed. The leaves are gathered from one to four times a year, but most commonly the gathering is divided into three periods, the first about the middle of April, the second at midsummer, and the last in the latter part of August. The tender leaves gathered in the spring are those most prized for their good qualities as to color and aromatic flavor. Those of the second gathering are not of so good a color, and are considered inferior in flavor; while those of the last are of a darker green, and of still inferior quality.

The leaves, as soon as gathered, are put into wide, shallow baskets, and placed in the air for several hours, avoiding a strong wind. The next process consists in wilting them on cast-iron plates heated by charcoal—about three quarters of a pound of the leaves being so treated at a time. They are constantly being moved about with a kind of brush till they are properly wilted, when they are taken in baskets to be rolled in the hands, after which process they are again placed on the heated plates, but now of a lower degree of heat, so as to dry them perfectly without scorching them or injuring their flavor. The leaves are then placed on a table and carefully examined, and every defective leaf taken out. The processes here described are, however, only applied to teas of the second quality, those of the first quality

being rolled and dried in a most careful manner, without artificial heat to hasten their preparation.

There are three kinds of *green tea.* The first is *Gunpowder* tea, which is made from young leaves that have not arrived at maturity of growth, and are dried in the air; this is the most highly valued article of tea. The next consists of the *Hysons*, which are very carefully picked, and dried with a moderate degree of heat; they are called by the natives *Hyssaen.* The third, called *Song-lo*, a name derived from the mountain on which it grows, is the most common green tea.

The *black teas* are of five kinds, and take their names from a mountain covered with tea plantations and called *Bou-y.* The first quality is called *Souchong*—the Chinese name being *Saatyang;* the next, *Pehoe*, named by the cultivators *Back-ho* or *Pack-ho;* the third, *Congou*, or *Kong-fou;* and the other two are teas made from alder leaves and called *Padre-Souchong*, or *Paosut-tcha.* The latter are highly esteemed for some supposed medicinal quality.

The Chinese consider tea too narcotic or stupefying when it is used in less than a year from the time that it is cured. They drink the infusion at all their meals, and without milk or sugar. The higher classes take it very strong and hot, while the laboring people are compelled to take it very weak. The latter often beg the tea-leaves that have been used by foreigners, and boil them over again; and they pronounce the tea they thus obtain as better than that which they can afford to purchase.

To preserve all the good qualities in tea, it should be confined in narrow-necked, glazed earthen jars, kept

carefully stopped. The Chinese have very costly jars of this kind for the purpose; and, it is said, use the flowers of the plant, or the expressed oil of them, for the purpose of giving their tea a fine aroma. The teas sent to us are often much adulterated by the Chinese, who cure large amounts of foreign leaves for the purpose of mixing.

Tea is less suited for young persons than for adults and aged persons. This is owing to the fact that it is not a sufficient substitute for nutritious food. Many aged people prefer their cup of tea to partaking of more nourishing diet; but the practice of so taking it is much to their injury, as almost all they obtain from the tea, if taken strong and in small quantity, (which is the most beneficial method,) is a pleasurable sensation and an invigoration of the system for the reception of nutriment, as it promotes digestion. But, as it is usually taken with milk and sugar, from both of which a little sustenance is obtained, it satisfies the appetite to the exclusion of a desire for such food as is essential to the better nourishment of the system.

Tea will relieve intoxication to a limited extent, and is most salutary in alleviating intense mental excitement. As an antidote for poison it is nearly as powerful a remedy as coffee. Cases of poisoning by tartarized antimony have been relieved by the administration of a very strong infusion of tea.

CHAPTER V.

COFFEE AND ITS PREPARATION.

The flowers of the coffee-tree exceedingly fragrant—The fruit and seed—Coffee sold at Constantinople in 1554—Was supposed to be intoxicating and its use forbidden—It was afterward permitted and taxed—Great consumption of coffee by the Turks—It was carried westward by the Venetians—The coffee plant first introduced into Europe in 1714—Was conveyed to the West Indies—Coffee indigenous in Arabia—Mode of planting and of gathering the berries—How coffee should be roasted—The proper way to prepare the beverage—When sugar and milk should be added—The beneficial effects of coffee in peculiar cases—Persons to whom it is injurious—Consumption of coffee in the United States.

THE Coffee plant or tree (*Coffee Arabica*, and called by some *Jasminum Arabicum*, from the deliciously sweet jasmine-like flowers which it bears) possesses, when blooming, such a sweet and powerful fragrance that persons unaccustomed to its odor, upon passing a coffee plantation in flower, become intoxicated even to unsteadiness of step. The fruit is a red berry about the size of a cherry; the pulp is quite insipid, and incloses two seeds formed as we receive them; but in the fruit these seeds are covered with a membrane, called parchment, that adheres to them after the pulp is taken off, and has to be removed by machinery. The coffee-tree is of moderate size, grows erect from eight to twelve feet

high, and has long undivided branches, which are very slender, bend downward, and are furnished with evergreen leaves. The blossoms are white and set upon short flat stocks, and, as we have remarked, resemble the flowers of the jasmine.

Coffee was publicly sold in 1554 at Constantinople, where it was introduced as a beverage by MEGALLEDDIN, Mufti of Aden, in Arabia Felix, who had become acquainted with it in Persia. The Syrian government, however, interdicted its general introduction, on the supposition that it produced intoxication, which is incompatible with the strictness of the Mohammedan discipline; and so great was the surveillance, that, at the capital of Turkey, the Mufti ordered the police to prevent any one from drinking coffee. But the passion among the people for its use was so great, that it was found impossible to enforce the prohibition; and so the government becoming aware of this fact, and knowing that the coffee plant was indigenous to its own country, then sought to make it contribute to its own advantage by levying a tax upon the sale of the beverage, which impost subsequently produced a large revenue. The consumption of coffee by the Turks is now so great as to induce the inference that it takes among them the place filled in other countries by wine and spirituous liquors, which are prohibited by the Moslem religion. And a supposed necessity for a supply of coffee is with them made a matter of such imperative importance that a man's wife, who may be deprived of what is considered a reasonable quantity, can present the deprivation as a legal cause for a divorce.

The Venetians, who traded much with the Levant, were the first to promote coffee in its advance westward. In 1615, PETER DE LA VILLE, a Venetian at Constantinople, acquainted his friends in Italy of his intention to bring some home, and spoke of it as an article then unknown in that country. In 1671, was opened in Marseilles the first coffee-house established in that city, where prepared coffee was sold to the public as a beverage. It would appear to have been made a subject of impost immediately on its introduction into England, as we find a duty of fourpence per gallon of coffee recorded in the Statute Book for 1660. From that time the use of coffee as a beverage extended most rapidly; in England it was sold in public-houses, and had the advance of tea not only in the public estimation but in the date of its introduction.

The first coffee-tree introduced to notice in Europe was in 1714 presented by the magistrates of Amsterdam to LOUIS XIV., king of France, and by him placed under the care of the celebrated botanist, JUSSIEU. Some years after this, plants were conveyed to Surinam, Cayenne, and Martinique; and in a short time the growing of coffee spread most rapidly. In 1732, its cultivation was considered of sufficient importance in Jamaica to call forth an act of the legislature in its favor.

The coffee-tree is indigenous to Arabia. The several varieties are supposed to have been derived from one parent stock, and to have been created by climatic influence. All, however, require a uniform warm climate of a temperature of not less than fifty-

five degrees of Fahrenheit. Excessive heat is quite injurious to the production of coffee, consequently cultivators plant at intervals, throughout the coffee field, rows of umbrageous trees which screen the coffee-trees from the overpowering rays of the sun. The plants are in full bearing after three year's growth. The flowering lasts about two days. In one night the blossoms expand and present a most peculiar effect, the appearance being very like that of a light snow-storm. The fruit is known to be ripe when the dark red berries begin to fall from the trees. In Arabia, cloths are spread beneath the trees, as the people of that country do not pluck the fruit, but allow it to fall, which may account somewhat for the superior quality of the Arabian coffee. Coffee grown in the West-Indies, upon elevated, dry, light soil, is quite equal, and by some is even preferred to that of Eastern growth. Coffee is much improved by being kept for a time, and this is most probably the only reason why the Turkish coffee possesses such good qualities.

Much depends upon the roasting of coffee. The application of heat produces important changes; it causes the bean to increase in size and to lose about one third of its weight, and a volatile oil, possessing a very aromatic odor, to exude upon the surface of the seed. It should be roasted in a close revolving cylinder, over a moderate fire, until it changes to a chestnut brown color; it should then be thrown into a glazed earthen vessel, having a close-fitting cover, and, after being well shaken for about five or ten minutes, set in a very cool place—the cooler the better—in order to cause it to retain the volatile oil

which imparts to it its delightful aroma. When ground, it should be only in quantity required for immediate use; and when the infusion is being prepared, care should be observed to retain as much as possible of the vapor, for which purpose coffee-pots are now constructed, and are valuable inventions. The clarifying of coffee by means of the whites of eggs and fish-skin deprives it of much of its good qualities—straining is far preferable. Milk, when used, should be hot. Milk and sugar add much to the nourishing qualities of the beverage, and assist in making it a most delicious adjunct to a breakfast. When taken after dinner, the milk and sugar should be omitted, as it is then intended only as a promoter of digestion, and the desired effect is much more decided without those ingredients.

Like tea, only much more effectually, coffee counteracts the effect of alcoholic drinks upon the brain and nervous system. It neutralizes the virulent effects of several of the vegetable poisons, such as opium and belladonna, and arrests excessive vomiting by allaying the nervous irritation of the stomach. Its influence on the brain is most happy, as it increases the activity and energy of that organ, and removes a sense of fatigue and dullness of disposition. It also resists the influence of cold and damp, and therefore is of great service to those exposed to a humid atmosphere in the night, while it invigorates the system in a warm climate. These good qualities account for the universal use of coffee, as well as for its abuse, for it is often taken in excessive quantities to the exclusion of more nutritious food. It should not

be indulged in by persons of a plethoric or full habit, as its tendency is to increase the circulation; consequently in persons thus circumstanced it induces such serious inconveniences as vertigo, congestions, and engorgements of blood-vessels in parts of the body predisposed to such ailments.

Previous to 1860, about 177,111,923 pounds of coffee were annually consumed in the United States; but in 1865, in consequence of the increase of price, the consumption fell to only 109,086,703 pounds, being a decrease of 68,025,220 pounds for that year.

CHAPTER VI.

COCOA AND CHOCOLATE.

Chocolate made from the seeds of the Theobroma—The *Theobroma cacao* cultivated in Mexico in the time of the Aztecs—Uses and properties of its seed—The cacao tree, its foliage, flowers, and fruit—The modes of manufacturing chocolate—Cocoa and broma—The use of chocolate in various countries.

CHOCOLATE is made from the seeds of several varieties of the *Theobroma* trees, as the *T. cacao*, the *T. speciosum*, the *T. sylvestre*, and the *T. subincanum*; but principally from the first-named. Theobroma, which signifies "food for a god," was the generic name given to these trees by LINNÆUS as a mark of his opinion of the excellent qualities of their seeds. The *Theobroma cacao* has been cultivated in Mexico ever since the days of MONTEZUMA, and has

been largely transplanted by the Spaniards into their dependencies. In the Mexican language its seeds are called *cacava quahuitl*, and the preparation from them, *chocolatl.* In the times of the Aztec kings the seeds were made use of as money, and acted the part of small coins. For their good properties as a diet they have been highly extolled to the present day by all who have become acquainted with their use. SCHRADER analysed the cacao seeds, and discovered in them the same valuable principle that exists in coffee and tea, *thein* or *caffein*, which contains the most nitrogenized substance found in vegetables.

The cacao tree seldom rises above the height of twenty feet; its leaves are oblong and pointed, and of large size; and its flowers are small and of a pale red color. These flowers are succeeded by oval-pointed pods, which contain a white pithy substance that is disagreeable to the taste and surrounds numerous seeds, each of about the size of an almond kernel, but of a rounder form. Some pods will contain as many as a hundred of these seeds. The outer covering of the seeds is a thin skin or husk of a light reddish-brown color, but internally they are of a dark-brown color. They are very oily and nutritious, although the Spaniards deny this fact, and thus excuse themselves for drinking chocolate on fast-days.

The natives of Mexico prepare chocolate for use in the following manner, and have done so from the earliest ages to the present time: They first roast the seeds of the cacao in earthen pots, and then remove the husks, after which they beat the seeds between two stones, and form the mass into cakes with the

hands. The process adopted in our own country differs from this only in so far that instead of being beaten the seeds are ground, so as to enable the manufacturer the better to form the mass into a smooth paste, to which he adds some flavoring, and then molds it into the shape in which the chocolate is sold. Chocolate, when pure, leaves but a small residuum in the cup; it is, however, often much adulterated with browned flour and butter, which make it softer than the genuine article, and render it offensive to weak stomachs. Chocolate cakes should be kept from the air as much as possible, as, when exposed to the atmosphere, they have a tendency to become rancid and unfit for use.

Cocoa is the beverage made from the husks or shells of the cacao seed, which always have a small portion of the oil in them. It is well adapted for delicate persons. The same beverage, when made somewhat richer, is called *broma.* The fixed oil that is expressed from the seed is of a semi-solid consistence, and is used for making cosmetics.

Chocolate is not extensively used in the United States; but, when used, it is generally made too rich and oppressive to the digestive organs; consequently cocoa and broma are more advised to be taken as beverages when tea and coffee are inadmissible. In France, it is held in great esteem; in Spain, it constitutes the ordinary breakfast; and in Mexico, according to HUMBOLDT, it is not considered an object of luxury, but rather one of prime necessity.

CHAPTER VII.

CONDIMENTS AND THEIR QUALITIES.

Condiments not only render food palatable, but are promoters of digestion—The more acrid varieties pernicious—The condiments most conducive to health—Salt and vinegar—Sugar, cream, butter, and oil render rich food obnoxious, but are advantageous when taken with plain food—Aromatic spices must be taken with caution—Onions and garlic have a sedative effect—When sugar disagrees with dyspeptics—Salt essential to sustain health—Its absence engenders worms in the stomach—Salt provisions produce scurvy—Vinegar in moderation conducive to health—It renders fatty substances more digestible—When taken in excess, it is injurious.

THOUGH Condiments demand a distinct chapter in a work like this, still they are difficult to separate and define, as such articles as the onion, butter, sugar, and oil—nearly all of which we have already discussed—may be classed among them. The nature of condiments, as generally viewed, is to impart a zest to food, to heighten its taste by an added relish, and thus to render it more palatable. But this is only one of the essential qualities they possess. The others are the promotion of digestion and the correction of the injurious properties of certain kinds of food—in a word, condiments stimulate into action the over-tasked digestive organs. It is not, however, claimed for them that they improve the tone of these

organs; and, consequently, they may be dispensed with for a time without injury. But persons who accustom themselves to the use of the more acrid varieties find it impossible to do without them, and have even to increase the quantity in order to satisfy their desire for them in their food, which they thus render unpalatable and obnoxious to the natural taste; and the result is that, in course of time, such persons can not digest their food without them.

There are, however, some condiments, such as *salt* and *vinegar*, which are of actual benefit and are requisite to sustain the system; but they must be taken in moderation, otherwise they will impair the health. *Sugar*, *cream*, *butter*, and *oil* often invite the appetite to an indulgence in an excess of rich food, and really render such food more obnoxious by their intermixture with it; but when they are taken in moderate quantity with plain food, they prove of actual advantage even to a delicate person. As *mustard*, *pepper*, and all the *aromatic spices* contain largely of volatile oil, the properties of which stimulate the nervous system, they should be taken with extreme caution. If taken to excess, their tendency is to impair the normal tone of the nervous system. The alliaceous plants,—*garlic*, *onions*, etc.,—on the contrary, have a sedative influence upon the nervous system, and are nutritious, especially when boiled. This influence has naturally induced a fondness for them; but as the effect produced is very moderate, no injury can be sustained from it.

Sugar, if eaten in a concentrated form—as in candies, preserves, and rich syrups—does not generally offend the stomach; but when it is much diluted—as in cof-

fee, tea, or other sweetened drinks—it has a decided tendency to ferment and to form acid. And thus it is that tea and coffee disagree with dyspeptics who can eat pure sugar with impunity. But from this it must not be inferred that dyspeptics can eat diet containing much sweetening without incurring inconvenience and suffering from the indulgence.

Salt is essential to the sustaining of health in nearly all animals. Those in a wild state obtain it from the earth in certain localities, which in this country are called *salt-licks;* and as these places are regularly visited and licked by wild beasts, they are often watched by the sportsman in pursuit of game. Every farmer regularly supplies his cattle with salt in order to keep them in health.

Children who have not been supplied with sufficient salt in their food are usually afflicted with worms; they become pale and bloated, and are without ability to digest their food. When thus afflicted, a judicious use of salt for a time will improve their health and rid them of the worms. Consequently, salt has been recommended as a remedy for the removal of worms in both children and cattle.

"The ancient laws of Holland," says Dr. Paris, "ordained men to be kept on bread alone unmixed with salt as the severest punishment that could be inflicted upon them in their moist climate. The effect was horrible; these wretched criminals are said to have been devoured by worms engendered in their own stomachs."*

Salt provisions can no more be endured with im-

* Paris on Diet, p. 78.

punity during confinement than the deprivation of salt, as, under such circumstances, they are supposed to produce the scurvy; while, in any case, if they are too much indulged in, or if salt is eaten in excessive quantity, disease of a milder form will be engendered. We thus learn that it is necessary to take even the essentials to health in moderation.

Vinegar, in moderate amount, is also conducive to health, and more especially if it is taken with cellulace vegetables. It is supposed by Dr. PARIS to render fatty, gelatinous substances more digestible. And it is worthy of remark that vinegar dissolves muscular fibre—that is, lean meat—so that it will become like jelly and be soluble in hot water. This latter fact was discovered by a very noted chemist, BERZELIUS. The consequence is that, if it is taken into the system in excess, it must be injurious; and it is well known that emaciation is produced in persons who freely indulge in the eating of pickles or lemons, the acids they contain being very detrimental to the stomach. Persons who in youth have partaken overmuch of these acids have suffered through the remainder of their lives from that continual distress in the stomach which is known as heartburn, although they had long previously abandoned the indulgence which gave rise to it.

PART VIII.

INCENTIVES TO HEALTH,

AND

MEANS OF RELIEF IN CASES OF ACCIDENT.

CHAPTER I.

BATHING AND THE FUNCTIONS OF THE SKIN.

The external application of fluids most grateful to man when fatigued—Bathing employed as a curative means—Was a religious observance among the ancients—Scriptural history of bathing—The Greeks indebted to the Egyptians for its knowledge—Cruel practice of the Spartans—Excessive cold water injurious—Judgment required in bathing—Sedative effects of cold water dangerous to some constitutions—Structure and organization of the skin—How it is acted upon by cold water—Relief afforded by the cold bath in cases of fever and inflammation—When the application of iced water is beneficial—The warm bath, and its remedial qualities—The hot bath and its stimulating effects—Is dangerous to persons of full habit—Precautionary measures—How to prepare a vapor-bath—Application of the fumes of alcohol or the spirit vapor-bath—The foot-bath and local applications.

PROBABLY nothing is more grateful to man, when fatigued and oppressed by heat, than bathing in a cool stream of water. And thus the bath has been resorted to not alone as a luxury when well, but as a curative means when sick—an idea induced from the relief it affords a person when he is tired and feverish from excessive toil. The flowing stream being one of nature's free provisions, and in primitive times the most convenient arrangement for cleansing and purifying the person, man in every stage of society has availed himself of the luxurious privi-

lege it presented, while at the same time he has enjoyed the rich advantage of inhaling the cool air of the shaded forest through which it passed. And as whatever affords him the greatest solace and adds most to his comfort tends to excite his religious veneration, so bathing and visiting the shaded forest have been enjoined as religious observances. The conviction innate in man of the virtue of purification, and of the essentiality of repentance—for which latter the silent forest offers a fitting place for solemnity of thought as to his sinful nature—would naturally suggest these observances as indispensable to obtain the forgiveness of an offended Deity. And that they were practiced in the primitive ages no doubt can be entertained, for we read that, before the days of Moses, bathing was resorted to, and was considered typical of moral purity. Jacob commanded his family to purify themselves and change their garments before they went to Bethel to sacrifice. In the book of Job we read of a similar purification by snow-water, which proves that cold bathing is of very early date. The Egyptian priests on the occasion of extraordinary sacrifices washed their bodies three times a day. The Jewish priests also washed their bodies before officiating in the temple; and the proselytes from heathen parents were immersed to their necks in the river, and were compelled to remain there until an exposition of some of the precepts of the law was made by the priest.

The Greeks were indebted to the Egyptians for their knowledge of bathing, as a part of the medical art, and very probably as a religious observance. These people, in common with the Jews, practiced

three kinds of purification —by bathing, immersing, or dipping, by washing of hands and feet, and by aspersion or sprinkling.* Extremes being ever the tendency of man, he is tempted to accomplish the acme of perfection without considering the necessity of gradation, a compulsory restraint enjoined by nature; and so he will suffer popular practice to usurp the place of his better judgment, and to lead him into the greatest extremes. The Spartans plunged their new-born infants into cold springs, and boasted of the robust constitutions of those that grew up. The practice could not be otherwise than successful in relieving them of feeble children, for only the robust could withstand the ordeal; and thus a sacrifice was made of all the enfeebled. This cruel infliction was a submission to public opinion and pride. Many of those who were destroyed by the sudden violence would, in the course of time, by gradual inurement, have rivaled in health those who withstood the severe shock; for the feeble infant, with proper care, often lives to enjoy a vigorous manhod and a ripe old age.

An ordinary capability, by being excessively forced to meet some demand or to resist some extraordinary influence, is often thereby so impaired as to place the recuperative powers beyond the ability to resuscitate, and thus a check is given to the progressive vigor of the system. It is not uncommon for heatthy and well-developed infants to disappoint expectation in adolescent age by becoming feeble, and exhibiting indications of disease and deformity. It is, therefore, most prudent for parents to observe care, and to exercise

* Bell on Bathing.

judgment in the inurement of their offspring to such hardy treatment as cold bathing. Some children will bear it admirably, while there are those whom, with careful gradation of treatment, it will much improve; but still there are others who will sink under its enforcement, and we must certainly consider it a cruelty to sacrifice these to the dictation of public opinion.

These remarks apply not only to children, but to adults of delicate constitution. Many a valuable life has been sacrificed to popular practices, urged by unreflecting friends, who have perhaps never given it a thought that, though all mankind are endowed with vital resistance and with ability to accumulate resisting power, yet some possess it to a far less extent than others. The responsibility of giving advice in such matters should alone be assumed by those who are most familiar with the constitution of an individual, and who are capable of making proper deductions from his or her past life; and none are more capable of giving proper advice than an observing, long-continued medical attendant, and the oldest, most interested, and most reliable member of the family. Then any experiment should be carefully made, and the perseverance in it limited according to the improvement, and never continued where actual benefit is not derived within a reasonable time; but above all, it should be introduced gradually, if proper regard is had for the life of the individual or for his or her future health.

Persons may die from the sudden sedative effect of cold water upon so extensive a surface as that of the whole body. It may so paralyze the nerves as to

greatly impair their vital energy, and thus it may be impossible for the blood to return to the superficial blood-vessels; or it may induce a sudden revulsion of blood from the surface to the large blood-vessels about the vital organs, and a consequent distention of those organs, which may become permanent, and cause the life of the individual to be ever after seriously imperiled by rendering him liable to heart-disease and congestion of various organs.

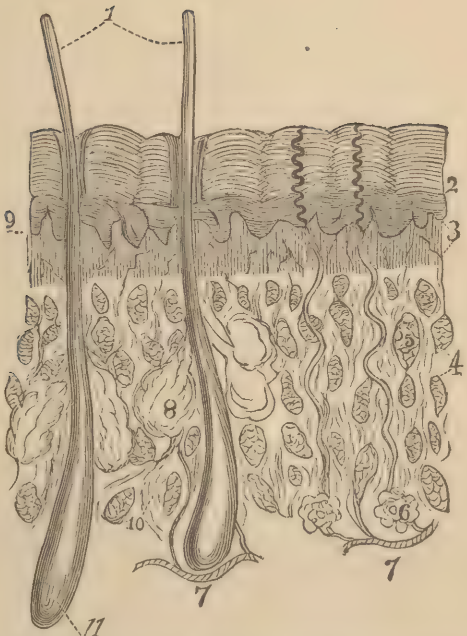
In order to enable the reader to comprehend more clearly the effects of bathing, we will here present a description of the structure and functions of the skin. We intentionally omitted this in a previous chapter, as we preferred to treat of the two subjects in conjunction, so that they might be rendered more comprehensible.

The *skin* covering the body of an ordinary-sized man has a superficies of about fifteen square feet. It is composed of three *laminæ* or layers. The outer one, called the *cuticle* or *epidermis*, is readily separated from the middle layer by chafing or blistering, and has not any sensibility; it is seemingly a mere outer protection to more sensitive parts. The next layer is of a soft, porous consistency, presenting a secreting surface, very perceptible when the outer layer is removed, and is exceedingly sensitive. This layer, called *rete mucosum*, consists of a profusion of small vessels conveying blood and lymph, and of a fine net-work of nerves; and it presents on its surface the color of the individual, which is perceived through the epidermis or scarf skin. The inner layer is of a dense, resisting character, and is called the true skin or *chorion*. The

outer layer permits the escape of perspirable matter and certain gases, which are given out from the terminations of the small vessels referred to; but at the same time it protects and to a certain degree prevents the introduction of injurious subs'ances. This protecting property is very apparent when the outer layer is removed, as then poisonous substances are most readily taken into the system and their effects manifested.

This very extensive organ performs other most important functions besides those of secreting insensible and sensible perspiration and eliminating gases. It also absorbs oxygen and nitrogen from the atmosphere, and performs functions somewhat similar to those of the lungs in respiration; and this is especially the case in some of the lower orders of animals, such as the frog, whose skin is of more vital importance in sustaining life than the lungs.

The skin is continued internally, and, by a slightly graduated modification, forms the lining membranes of the nose, mouth, and internal organs; hence the sympathy that exists between those membranes and the external skin. If the secreting function of the latter is impaired by constriction or enfeebled by excessive evaporation, that is, by what we term "taking cold," the internal mucous secretions, as, for instance, those of the nose and bronchia from the lungs, are increased, and diarrhea not unfrequently supervenes. By exciting the skin into its wonted action, and inducing a free perspiration, the internal activity is arrested, and in mild cases an equilibrium is established. But if an excessive irritability, amounting to congestion, is



VERTICAL SECTION OF THE SKIN GREATLY MAGNIFIED.

1. The *hairs* passing up from their bulbs.
2. The *epidermis*, or scarf-skin, having the appearance of scales placed one over the other.
3. The *dermis*, or true skin. 9. The *rete mucosum*, forming the upper surface of the *derma*. It is this layer that contains the coloring pigment of the skin. as the black color of the negro.
4. The *subcutaneous cellular tissue.* This contains the *fat-cells*, *sweat-glands*, and *ducts* extending to the *epidermis.*
5. The *fat-cells.*
6. The *sweat-glands.*

7, 7. The *arteries*, giving branches to glands, all parts of the skin, and hair-bulbs.

8. The *sebaceous glands* of the hair.
9. The *rete mucosum.*
10. The *fibrous filaments* pervading the skin.
11. The *hair bulb.*

established, then irritability is kept up by the pressure of the engorged blood-vessels, and much excitement of the nerves is produced; and this excitement requires for its relief a more decided medication, and if it is not relieved, disorganization ensues. The nerves, too, play an important part, more especially in fever, when they are morbidly excited, and constrict the secreting vessels both internally and externally. If the irritability is allayed, perspiration, accompanied by a movement of the bowels, ensues, and the patient obtains relief; but as this object is not always readily obtained, experience and skill are required to accomplish it.

From this we learn that it is important to maintain the healthy functions of the skin, and that any extraordinary violence which produces a sudden interference with the action of those functions tends to derange the whole system; and this derangement is in exact proportion to the deficiency of resistant power in the skin. From its exposed surface, this power is, in the adult, greater in that organ than in any other of the animal economy, but such is not the case in the new-born infant. It can be accumulated by gradual invitation, where there is sufficient natural stamina to afford it; but the amount of such stamina is limited in each person to his actual physical strength.

With the delicate an indiscriminate use of the *cold bath* and extraordinary exposure to cold, damp air are most common causes of incurable diseases. The application of cold water to the skin acts: *First*, as a repellant, by constricting the secreting vessels and arresting nervous energy, and, as a consequent, numbness follows, when the prick of a pin is scarcely felt; and, if it

is continued long, first the fingers, and then the limbs, fail to move with freedom. And, *secondly*, it causes the natural heat of the body to be conducted off so rapidly as to deprive the internal parts of their wonted heat –98° of Fahrenheit. Under such circumstances, experienced observers have remarked the circulation to decrease from ten to fifteen beats per minute, thus to a considerable extent diminishing the ability to furnish heat. In fact, so great is the benumbing effect upon the nervous system that, even after leaving the bath, the temperature of the body will remain for a considerable time below the natural level. Such has been the experience of ATHELL, MACARD, BUCHAN, and Dr. CURRY, all writers upon the use of baths. The effect of an impression like this upon a delicate, nervous person must certainly be most serious, and especially upon one whose circulation is feeble. For a considerable length of time after bathing, persons of this class usually experience cold, shivering languor, dullness of the senses, disinclination to thought and motion, and pains in the head and joints, all of which are accompanied by a feeble pulse; while some persons have a gradual diminution of nervous power resulting in paralysis.

The *cold bath* affords much relief in cases of fever, and, when applied locally, in some instances of local inflammation. It may also be of service to persons of robust constitution who do not labor sufficiently to expend their natural quantum of excitability, which renders them dull and sluggish, and at times subjects them to headaches and various ills of oppression, and makes them appear to the superficial observer like

those who are afflicted with feeble constitutions. In such cases the cold bath, if persevered in at frequent intervals, acts as a sedative, and not only abstracts the superabundant heat, but lessens the disposition to its accumulation. Hard labor would accomplish similar good results.

In cases of extraordinary excitement of the skin, amounting to actual irritation, caused by excessive heat—such, for instance, as results from taking very hot baths and having the surface irritated by stiff brushes or switching—water at the temperature of snow acts as a soothing sedative, and brings the system into a state of equilibrium, though at the time it is in one of actual exhaustion, inducing an inclination for rest. And thus it is that a disposition to quietude and apparent comfort follows the taking of one of the "Russian baths," which sensation is very analogous to the relief afforded to a person laboring under fever by the skillful application of cold water externally and internally. In both instances he is inclined to sleep, for in neither does he obtain either strength or vital energy. This fact teaches us that cold baths are actually injurious to the delicate young, to the enfeebled adult, and to the aged.

Moderately cool bathing, gradually reduced in temperature, may in some instances induce an ability in the system to resist the influence of cold; but even this practice must be carefully tested, for, if an individual has not the stamina to accumulate vital energy, he will be seriously injured by it. If the person is young and the practice is continued, all the indications of scrofula will supervene; and if advanced in

age, then paralysis will be induced. These derangements may not follow immediately, but the impression made will result in them.

Iced water applied locally, or as a general bath, affords most decided relief in cases of excessive nervous excitement. We have already remarked that persons prostrated by alcoholic intoxication have been relieved by pouring cold water on their heads; and that in cases of delirium tremens relief has been obtained by immersion in ice-water, by which sleep has been induced, even after opium had failed to quiet, so powerful is the effect of cold water as a sedative.

Bathing in water at the temperature of 98° has the least possible tendency to injure, and a direct tendency to benefit both young and old, especially when soap is used, for then not only the exposed surfaces, but the whole body, is cleansed. Thereby a most favorable impression is made upon the sentient nerves and secreting vessels; and the obstructing secretions are softened and removed, which is as essential to the enjoyment of perfect health as is the regulating of the bowels to stated periods, not exceeding twenty-four hours' interval. In order to maintain such health, washing the surface of the entire body is not required so often as washing the exposed parts, but it should be practiced quite frequently, and more especially by persons having oleaginous secretions, which we have heretofore stated are very apparent upon their clothing. A bath at the temperature just mentioned is usually denominated the *warm or tepid bath:* the temperature, however, may be varied from 75° to 98°, as may be most congenial to the feelings of the per-

son. In fact, it can be so modified as to render the warm bath one of the very best remedies for nervous irritability, from whatever cause it arises, for impaired health, or for fatigue; and as illustrative of the latter we may mention the wayworn traveler, to whom it is one of the greatest luxuries, soothing his nervous system, and removing from his skin the excessive accumulation of dust and of cutaneous secretions produced by extraordinary exertion, both of which act as irritants. Its sedative influence in allaying morbid irritability predisposes to a quiet sleep, during which the internal powers prepare and accumulate a disposable force for continued exertion. This is the proper bath for the feeble and delicate, if it is not immoderately indulged in. If feverish or much excited, a longer continuance in the bath than would be ordinarily advisable may be advantageous. But this greatly depends upon the condition of the person, as its sedative effect upon the nervous system will lessen the circulation of the blood and enfeeble the physical powers; hence it is said, and truly so, that too frequent bathing or washing of delicate babes is injurious, as it lessens the excitement necessary for the attainment of growth and vigor.

The *hot bath* is from 100° to 112°, and differs essentially from the warm or tepid bath, as it is a stimulant, and ought only to be used as such. While the latter soothes and disposes to mental and corporeal quietude, the former communicates heat to the body, and excites the nerves and the circulation of the blood to such a degree as to be exceedingly dangerous to persons of full habit. The condition of such persons

when under its influence is: Swelling of the fingers so as to preclude the possibility of removing the rings, congestion of the blood-vessels about the head, quickening of the pulse which becomes full, and rapid and laborious respiration which are followed by palpitation of the heart, while even apoplexy has been known to ensue. These effects are produced in direct proportion to the duration of immersion, and to the temperature of the bath.

A valuable precautionary measure, to avert the determination of excitement to the brain and nerves when taking a hot bath, is the application to the head of a sponge charged with iced water, which should be renewed and continued as long as the person is in the bath. The same practice should also be observed by persons under the influence of hot vapor from water, or of the fumes of burning alcohol, as they tend equally with the hot bath to produce extraordinary excitement, first, of the superficies of the body, and, lastly, of the vital centres. When any of these agencies are resorted to as a means of counteracting internal irritation, and of establishing a healthy action in the skin, and when they are skillfully applied, they are most salutary remedies.

The vapor of hot water, or the *vapor-bath*, is most readily applied in the following manner: Take a blanket, gather up one of the narrow sides, and tie round it firmly a strong cord; after which, place within the end so tied, and close up to the tie, a hoop from a flour-barrel, and, so as to keep it in its place, fasten it by means of strips of cloth passed round the rim and pinned to the blanket. When raised up, this

will form the top of a tent, to which the rest of the blanket will supply the sides; and this tent may be easily suspended by attaching the top to one end of a strong cane, the other end being passed over the top of a door, partially open, and under the door frame. If within this tent is placed a vessel containing about two gallons of hot water, into which a few hot bricks are from time to time plunged, a sufficient amount of vapor will be generated and kept up to afford a very decided vapor-bath for a person either standing or sitting within the tent.

The *spirit-vapor bath*, composed of the fumes of alcohol or ordinary spirits of good strength, may be applied as follows: Pin one extremity of a blanket about the neck of a person, and then seat him on an open-bottomed chair, after which spread the blanket over both the person and the chair, with the open side to the back; next put under the chair a saucer placed on an ordinary porcelain plate, and containing about half a gill of alcohol, and then ignite the spirits with a lighted match. This vapor may also be conveyed into the bed of a sick person by means of a curved tin tube with a funnel-shaped end, the large end being placed over the alcohol, and the bedclothes being sufficiently elevated by rolled blankets placed a short distance from each side of the patient. The application of the spirit-vapor produces a most decided stimulant effect upon the skin, and is most valuable, as it excites and maintains the wonted circulation of the blood in that organ, and restores to it its secreting functions, which are always deficient when internal irritation exists, let it be of the stomach, the bowels,

or the lungs. It is also a valuable remedy in chronic rheumatism, and neuralgic affections, but more especially in chronic derangement of the bowels, whether of children, adults, or aged persons.

Local baths are often of great service, especially the *foot-bath*, or *pediluvium*. In cases of excessive excitement about the head, throat, or chest, a very hot foot-bath is a valuable means of relief, and much advantage is obtained by immersing the hands at the same time. Apoplectic seizures have been relieved by the application of very hot water to the feet and hands, and at the same time of pounded ice in a bladder to the head. Cloths steeped in cold water and applied to inflamed parts, and reapplied at frequent intervals or kept wet, is one of the very best remedies in cases of local inflammation. The safest practice, however, with persons unaccustomed to bathing, is to use water at a temperature of about 70°.

CHAPTER II.

CLOTHING AND THE EFFECTS OF COLD.

Clothing contributes to health—The evils attendant on being insufficiently clad—Neatness in dress commands respect—Children sacrificed by fashionable clothing—Drafts in street cars a prolific cause of death—Concentrated drafts of air decidedly injurious—Effects of cold on the young and the aged—Cold air acts upon the system like cold water—A torpid skin the result of sedentary habits—Exercise, not clothing, the proper remedy—Clothing should be worn in accordance with surrounding circumstances—The skin best protected by flannel—How children should be dressed by day and night—Flannel retains heat, but linen absorbs it—Cold feet must not be permitted—How they can be prevented—Sacrifice of women and children by wearing thin shoes and stockings—Exposure of the limbs of children tends to paralysis—Treatment of paralyzed parts—Waistbands and high-laced boots injurious to children—The necessity for frequently changing underclothing—Persons who should be carefully guarded against cold.

CLOTHING contributes largely to the health of man; and its imprudent use has been as much the cause of both physical and mental suffering as any other evil to which he is subject. Insufficient clothing has led to many persons for years lingering out a life of pain—persons who could not excuse themselves for their folly on the score of poverty, but who were induced by a false pride to conform to the rules of some frivolous prevailing fashion, even against the wishes

and advice of their best friends. And there are many more who have had to experience the mental anguish attendant upon the loss of a favorite child of brilliant attainments, or upon the decease of some valued friend who has committed this species of self-immolation.

Clothes, when properly devised, not only contribute to personal comfort, but are conducive to health and longevity. Their conformation should be one of the studies of mankind, for the style of dress is often taken as an index to the character of the individual. Men and women who are tastefully attired invariably command respect, even though the materials of which their habiliments are composed are of the most ordinary quality. Indeed, it is often the most costly material that is the most unfavorably fashioned, and contributes the least either to personal appearance or to personal comfort.

Children are constantly being sacrificed, by their parents, in conformity to the fashion of the day, causing the most sensitive parts of their bodies to be exposed, and, while so meagrely clad, submitting them to most unfavorable circumstances; as, for instance, keeping them in overheated rooms, and then permitting them to encounter sudden drafts of air by running out into the hall, especially when the outer doors are thrown open. Another grave error is that of persisting in confining them to the house, from the fear that they will catch cold if allowed to go out; instead of which they ought to be properly clothed and exposed to the open air every favorable day. If thus clothed and exposed, and sudden drafts of air are avoided,

children of moderately good constitutions will not be attacked with croup and inflammation of the lungs; and, all other circumstances being equal, will enjoy good health.

Probably one of the most prolific causes of death to children arises from taking them out of warm houses, on mild days during the cool season, and almost immediately taking them into the city railroad cars. The doors at the ends of these cars are, on such days, usually open; if not, it is highly probable that some mother of a family of children, wrapped up in her furs, and very warm from active walking for a few blocks, will enter one of them and order the windows down, little suspecting that for her own gratification she is endangering the lives of the children, and adults with delicate lungs, who may be her fellow-passengers. This is a most common occurrence. Twenty minutes' ride under one or other of these circumstances has caused the death of many an infant and adult, while an hour's walk would have improved their health. The ride would not be injurious if the front-door and the side-windows of the car were kept closed. The ventilators on the roof and the after-door are all that it is safe to leave open on a damp, chilly day. Even on the hottest day in summer, it is decidedly injurious to have merely both doors or a front-window and the rear-door open, thereby creating a draft, and only safe when all the side-windows as well as the doors of a car are open. In a word, it is a concentrated draft of air that passengers should guard against. When a person is in a quiescent condition, such a draft deprives the system of its vital energies too rapidly, and in direct

proportion to his or her want of vigor. The most delicate person is not injured by walking in the open air, even though it may travel with as much and even greater velocity than a draft would course through such a confined place as a passage-way, or through an open window; for the exercise of walking tends to the accumulation of energy equal to the expenditure. Five minutes' exposure, while a person is in a stationary position, to a concentrated draft of air at a temperature of seventy degrees, is more injurious than an hour's exposure while walking in the open air at a temperature of forty degrees; while in either case the influence of the air would be modified by clothing and by the vigor and age of the individual.

It is a well-established fact that the young and the old are least able to resist the depressing influence of cold, and that the former are in general the least guarded against it. Dr. W. F. Edwards, in treating on the influence of physical agents on the animal economy, has demonstrated by actual investigation that the young have at birth the least power of producing heat, and that this ability to generate heat gradually increases, and in direct ratio of vigor, to adult age. He has also shown that heat parts from children much more readily than from adults. Hence the necessity of protecting as much of the surface of the body of the child as it is possible, and of modifying the clothing in accordance with the temperature and the exposure.

An excess of clothing during confinement in warm, close rooms has a direct tendency to enfeeble both young and old, as the skin thereby becomes exceed-

ingly sensitive to cold, from which it ought to be carefully protected, especially the surface of the extremities of the body. But this is not the only evil that arises from such a debilitating practice. In children an excessive perspiration is induced at the expense of the normal vigorous development of the internal organization, tending to morbid derangement, which is very analogous to scrofula, and is most probably one of the primary causes of that ailment, as the proper organic functions are not sustained for want of a sufficiency of oxygenized air to maintain the skin and lungs in their wonted action.

The restless activity of children greatly favors them in the generation of vital force to resist the effects of cold. In this they differ decidedly from old people, who cannot exercise themselves, and who consequently require at all times much more clothing than children. However, both children and enfeebled persons, when in a quiescent state, should be properly protected against cold, and, under all circumstances, should never be allowed for any length of time to experience chilliness or suffer from cold feet.

The effect of cold air is very similar to that of cold water, and is proportionate to the susceptibility of the animal system from an enfeebled condition of the skin or from the general economy. Both repel the circulation from the surface upon the internal organs, and, if continued, disorganize them and eventuate in their destruction. A torpid skin is often the result of sedentary habits; torpid bowels predispose to chilliness and cold feet. In such cases an increase of clothing is not the proper remedy. Exercise in the open

air, gradually introduced, is the wiser course to pursue; but care must be taken not to overexert or fatigue the system, as a person so situated will not possess sufficient vital force to sustain an amount of exertion that might be considered even moderate exercise in another, differently conditioned, though of like physical proportions. The exercise must be regulated by the amount a person can endure without feeling much fatigue, and it must be determined by the individual that he is wearing a sufficiency of clothing to keep himself comfortable under the existing circumstances. Exercise is essentially necessary to excite the whole organization into activity, so that the wonted functions may conduce to the proper sustenance of the body. The Creator has so constituted man and all the living animals that, when under the influence of life, motion is essential to the maintenance of their respective forms; and if this law of nature is not obeyed, suffering is the penalty for the infraction. Clothing and artificial heat will not compensate for the neglect of exercise in the open and pure atmosphere.

Health requires for its maintenance food sufficient to afford a certain amount of vigor to be expended in exercise, the proper limit of which latter is marked by fatigue; and enough clothing to protect the system under all circumstances, and by both day and night, from chilliness, but not an amount that will feel oppressive and make a person uncomfortably warm when quiescent in a temperature of sixty degrees. The clothing should also be sufficient to protect the body from cold when walking briskly out of doors in a temperature of fifty degrees. When the temperature is below

that point, it will be necessary to put on extra clothing, but this should be removed while within doors when the temperature is sixty-five degrees and over.

During the summer, the clothing should be light and not oppressive, and in our variable climate gauze flannel should be worn next the skin. The latter is especially required by children, for, as we have remarked, young children have less vital force than adults to resist the effects of drafts of air; and this shows the necessity of protecting all parts of a child's body and limbs in warm weather with very light fabric; but if this cannot be submitted to through the day, the child should be dressed during the night in some garment so contrived that it will be impossible for it to get naked. It matters not how light the material may be; if it is strong enough to be worn, it will be sufficient to protect the surface from excessive evaporation, which renders the skin cold to the touch, and not only impedes the circulation in that organ, but predisposes to a derangement of the internal organs. The same precaution should be observed by delicate persons of all ages, and more especially by those living in unhealthy localities. By the constant wearing of flannel, persons residing in very unhealthy districts, whose constitutions have been feeble, and whose health has been impaired by unfavorable influence, have been not only relieved, but have had their constitutions rendered comparatively healthy.

The good qualities of flannel consist in its not conducting off the heat of the body, and in its protecting the surface or skin from being rapidly deprived of it; hence its beneficial effect upon aged and feeble per-

sons, who are unable to generate heat rapidly. Linen absorbs heat, and most decidedly so when moist. The sensation of cold is very manifest in damp linen, but not in damp flannel. Linen should not be worn by children, or by persons predisposed to diseases of the lungs or bowels, to rheumatism, or to catarrhal affections, as the mucous membranes are invariably affected by a sudden chill upon the skin, and often by cold, damp feet, while at the same time the body remains warm. This should never be suffered, if it is possible to guard against it. In cold, damp weather, boots or shoes should be worn that are large enough to admit cork soles covered with flannel, which should be tacked fast to the inner soles. Good woollen socks or stockings should also be worn, and frequently changed, as the excreta of the feet, which are very considerable in healthy persons, are confined by means of the leather and absorbed by the woollen. The secreting of the feet is one of nature's healthy processes, but it is often impeded and arrested by the wearing of thin, light shoes and stockings, and by the failure to take free walking exercise. Unhealthy persons are almost invariably afflicted with cold feet, cold hands, and torpid skins, which are curable in many cases by judicious clothing and exercise. They would, however, establish a good condition of health if they would induce an equilibrium of the circulation.

Persons generally are well aware of the sympathy that exists between the feet and the internal parts of the system, and will inform their physicians that their ailments have been caused by getting their feet wet, most commonly by wilfulness or gross negligence

which not unfrequently costs them their lives. It is but seldom that the most vigorous in health can endure wet feet with impunity. Men usually guard themselves against the danger by wearing water-proof boots or overshoes; but delicate women will, and children are permitted to, wear light cotton stockings and single-soled shoes, and, in extremely wet weather, very light india-rubber overshoes. This self-sacrifice by women of health and life, and this immolation of their children to the god of fashion, is most devoutly practised. And it is but seldom that an immunity from the sacrifice of health is permitted in the dress of either women or children. This deplorable condition of society, in the midst of free and liberal education, ought not to be tolerated, and would not exist if our most opulent families set an example by wearing clothing suited to the exigencies of the seasons and to individual circumstances. If they would do this, they would fulfil the intention for which clothing was instituted—a protection against unfavorable atmospheric influences, whether in or out of doors, care being taken while within doors not to overclothe so as to enervate the system.

To adapt ourselves to varied influences, special care is required. When the ordinary clothing is worn during extraordinary activity, such clothing should not be immediately removed, but comfort should be obtained by rest, avoiding a change of temperature. This is a salutary precaution, necessary to be observed by the most vigorous in health. But if under such circumstances the clothing is removed from the neck, the upper portion of the chest, and the arms, a covering

of some thin fabric should be substituted, so as to impede the excessive evaporation that would affect the superficial circulation of the blood in those tender parts, which ought never to be exposed in either adults or children. In children, such exposure has been one of the most prolific causes of inflammation of the throat and chest, while a like exposure of their legs and inefficient protection to their feet has frequently resulted in inflammation of the bowels. The revulsion of the blood from the surface in many instances establishes a permanent irritability of the nervous system, which, from slight exciting causes, terminates in the most serious derangements, among which may be classed paralytic seizures resulting in the deformity of one or more of the limbs.

One of the most favorable auxiliaries in the cure of these cases of paralysis is the protection of the parts affected from the influence of cold, the temperature in these parts being always lower than that of the unaffected portions of the body. Whatever will contribute to the establishing of warmth therein is also beneficial, and so friction, manipulation, warm covering, and motion, are efficacious. In such applications, however, care must be taken to prevent the larger muscles (as is their tendency) from contracting permanently in consequence of the want of counteracting force in the lesser muscles, which is a cause of deformity that can only be obviated by skillfully constructed apparatus that will sustain the limb in a normal position, and will enable the patient to use it and thus obtain motion.

But the most expedient course to pursue is the precaution to guard against the unfavorable influences

that produce these sad afflictions. Clothing should be so fashioned as to subserve to the convenience of the varied movements of the body without constriction, and more especially constriction in a narrow space, such as is caused by the wearing of a girdle. The tightened band that is most commonly worn about the waist has produced many most serious derangements in both males and females, but more especially the latter, and has often subjected them to painful inconveniences, which, under varied circumstances, are more or less serious. The laced boots now worn by children are a prolific cause of weak ankles, as they impede the circulation of the blood by constricting and depriving the cords or tendons of the feet of their wonted freedom of action. The result is the interruption of the growth and vigor of the ankle and the arch of the foot, which induces an inward tendency of the ankle and a yielding of the arch of the foot. The high heels on these boots also contribute largely to the derangement. If the ankle requires support, it ought to be applied by the means of vertical steel bars, softly padded, and sustained by encircling bands of metal that will not compress the ankle, and can be worn within the shoes. The most firm leather that can be obtained will, after a few days' wear, conform to the shape and yield to the lateral tendency of the ankle, and will often contribute to the difficulty by impeding the circulation and maintaining the unfavorable position. Hence stiffened laced boots ought not to be relied upon as a curative means for weak ankles, and should not be worn by young children, for their tendency is to weaken the

ankle by limiting the motion. High shoes, worn with leggings or gaiters, are the most comfortable and salutary for children during the winter season, when they are exposed to the cold air; that is, if the shoes are sufficiently large for the feet, and will admit of thick, warm stockings, by the aid of which both the legs and feet are protected, while the blood is permitted to circulate freely and to contribute largely to the sustaining of warmth.

The frequent change of underclothing is an essential requisite to the maintenance of health, as the excreta of the skin, which, we repeat, are considerable in healthy persons, are retained by the clothing, and will become more or less intermingled with the atmospheric air, and be returned into the system. The skin, we have previously remarked, performs a very similar function to that of the lungs; it therefore requires pure air for the promotion of health. Hence the necessity of observing cleanliness about the person, and of protecting the skin from any unfavorable influences, and especially from becoming enfeebled by excessive perspiration and consequent evaporation, which produce chilliness, and from exposure to cold, which impedes the free circulation of the blood in that organ. If the circulation in the skin is interrupted, there will be an excess of blood in the internal membranes, which will predispose them to derangement, and, as cold is a most decided sedative, not unfrequently induce a torpor of the whole system. It must not be inferred, however, that cold repels the heat from the surface internally, and that it is returned with increased vigor, even in robust persons. This is

not the case. The heat is dissipated in the cold media, and the system is deprived of its natural quantum; and time, in proportion to the vigor of the system, is required to accumulate the wonted status or natural condition. The reaction that takes place, and the seemingly increased glow of warmth, is a deceptive nervous sensation. The thermometer, if placed in the mouth, will show a diminution of heat when this pleasurable sensation is experienced. And this proves the advantage that is obtainable from cold air or cold water in cases of fever, where there is an excess of heat in the skin; and the reverse where there is an inability to accumulate a sufficiency of heat, in consequence of a feebleness of the nervous system, from which severe chills ensue, and, at times, torpor resulting in death.

Children, constitutionally feeble persons, and the aged, should be carefully guarded against the influence of cold. Where persons possess but little ability to accumulate an increase of temperature—such as there is in the normal condition of persons of sound constitutions, and, as is the tendency of the animal system, if sufficient stamina exists, and time is given for its accomplishment—an appreciable amount can be obtained, under gradual exercise, by inurement to the cold bath, and by exposure to a limited degree of cold. But this depends upon the physical ability; for where it does not exist, these influences are decidedly injurious. In the attempt to invigorate feeble children or delicate adults by exposure that others endure with impunity, all the indications of scrofula are produced, and sometimes some immediate fatal disease. Whatever has a tendency to enfeeble or ar-

rest the vital energies of the system is injurious. Whether it be cold, fear, grief, want of proper nutriment, over-anxiety, excessive excitement or labor, confinement in overheated rooms, an excess of clothing in warm weather, or exposure to an atmosphere deprived of its electricity, the effects will be very analogous upon the animal system, and in ratio to its vigor and to age. These depressing influences are fearfully operating upon all classes of people at the present time; but more especially upon the inhabitants of our populous cities. The millionaire ever anxious about his investments, the tradesman ever desirous for patronage, the master mechanic wrestling to complete his engagements with a profit, the poor laborer sorrowing over his increasing family or over sickness—the result of deprivations—and lastly, the reckless politician and the pursuer of pleasure and vice, all suffer from their irregular habits; and it is these people who are the parents of those feeble children, the majority of whom so fearfully enlarge our bills of mortality, while the survivors constitute our rising generation. To insure physical improvement, these apparent evils must be obviated, and the diet, the clothing, the exercise, and the temperature to which the people are subjected, must be carefully regulated.

CHAPTER III.

PHYSICAL EXERCISE.

Exercise a manifestation of life—It is essential to its well-being—The first exercises of the infant—Discipline necessary in the exercise of children—Objections to the cradle—Riding more beneficial to children than being carried—Causes which lead to children becoming tender—How it is that poor children endure great exposure—Their habits of life—The practical lessons we obtain from them—Modification in treatment necessary for delicate children—Vital force exhaustive—It is increased by gradual demand—Muscular activity maintained by nutriment—The benefits which accrue from *active* exercises—The injurious effects of fatigue—When *passive* exercises are advantageous—Pleasure should be associated with exercise—When exercise is most salutary—Special exercises for the restoration of lost powers—Excessive exercise should be avoided—Treatment in cases of deformity—Club-feet and their cure—General deductions.

THE starting-point in physical exercise is naturally the first movements of the living economy, which are independent of the will, and are produced by *the contraction and extension of the organized muscular fibre.* The heart contracts upon the blood, and by vital energy forces it out to the superficies of the body. It then, by this peculiar energy, and independent of the will, alternates its action, and, extending its fibres, thereby enlarges its cavity to receive a return of the blood; this operation is facilitated by

a contraction of the muscular fibres in the blood-vessels, which also perform their functions under the same influence, and alternate in their action. By this means, we have the circulation of the blood established in the animal body. The activity requires to be sustained by the vital force, which is exhaustive, and is supplied by the will bringing muscles into action subservient to desire, when muscular motion increases the demand and leads to the further development of the body. Growth and strength are dependent upon muscular activity, sustained by proper nutriment; but every organ constituting the animal form, *per se*, is limited in its power, such limit being determined by circumstances, the most favorably constituted having, as experience has to a certain extent proved, a maximum limit, that can only be developed by very propitious events.

The new-born infant, in crying, freely exerts its little jaws and tongue, and the muscles of the chest and abdomen; while at the same time the legs, the arms, and even the toes and fingers, are all put in motion. In addition to its own efforts of *voluntary motion and exercise*, the babe soon learns to call loudly for handling—an instinctive impulse to its own advantage in the way of exercise. The first exercise to be recommended to an infant is to place it, when a few days old, upon a soft pillow, and gently agitate it on the knee. This may be denominated *passive exercise*, as the motion of the body is very similar to that obtained in riding, which is independent of a person's own muscular effort. The practice may be increased as the vigor and strength of the babe increase, for it

will promote activity in the system, and be conducive to development. Infants who are much confined to a quiescent condition are liable to become dull, inanimate, and exceedingly fat.

Exercise should not be given irregularly, nor at all times. A regular discipline should be strictly enforced, for such discipline is as essential to the exercise having a salutary influence upon the child as it is to the relief of the attendant. The natural disposition of an infant induces it to sleep after it has been nursed or suckled, when all the powers of the system are concentrated to digest the food. This is beneficial to the babe, as the vigor it obtains from food is not expended in outward form, as it is by labor, but is appropriated to the development of the body. After sleep, a brisk handling of the child will enliven the nervous energies of its system, and induce an appetite. Then, when a suitable interval has elapsed after digestion and exercise, the system will be benefited by a regularity of necessary supply, and the organic functions will be regularly performed, and never injured by being overburdened, as they would be by an irregularity in taking food. As desire is prompted by the wants of the system, and as habit governs desire, the child will be reconciled to this regularity. A due observance of stated periods for taking food, exercise, and rest are necessary to obtain a reasonable prospect of a healthy child.

No imprudence in regimen contributes more to the catalogue of diseases and indescribable ill health, whether in children or adults, than irregularity in taking food and rest, for neither of which is there such satis-

factory desire as that induced by agreeable exercise. In order that the full powers of the system may be brought into their wonted vigor, a strong desire for food and rest is requisite. In fact, for the enjoyment of health in every period of life we are dependent upon regularity in partaking of food, exercise, and rest; and if regular habits are commenced in early life, and continued, we insure both vigor of constitution and longevity.

Various exercises have been introduced for infants, the most common being rocking in the cradle. This is usually commenced after the child is a month or so old, and continued for about eighteen months, but the practice is condemned by many. The greatest objection to the cradle is that its contracted form tends to an unobservable habit of confining the child's limbs, and causes it to be rendered injuriously warm by the covering being compacted too closely about it. The latter induces excessive perspiration and leads to serious injury; for, upon the child being taken up, it is often exposed to the cool air, which, owing to an infant being more sensitive than an older person, produces chill. However, under other circumstances, such an exposure would prove of actual benefit to its health.

The rocking motion of a cradle, if moderate, is a pleasurable exercise for an infant, and is not objectionable; but violent rocking and jolting is decidedly injurious, as it agitates the brain and endangers the intellect. It is a cruel treatment, and will often frighten a child into a state of quietude, even when it may be suffering from some internal pain. And again,

the child, when gratified with moderate rocking, is frequently kept in the cradle when it would be much to its advantage if it were carried out in the nurse's arms, or were dandled on the knee. Either of these would give it a more perfect motion or agitation, with the additional advantages of a partially upright position of the body, and of air, both of which are conducive to its health, are as essential as motion, and when combined are most beneficial. Still, taking an infant out into the open air should be introduced gradually and regularly, so as to inure it, as it advances in age and strength, to out-door exercise; besides, it should by all means be comfortably clad, and, when drawn in a little wagon, have the body placed in a nearly upright position. The exercise it obtains when so situated is preferable to that which it gets in the nurse's arms while walking, in addition to which it is more gratifying, and is therefore rendered more beneficial. When the child can walk, it should be allowed to do so in the open air to the extent of its ability, that is, provided no unfavorable circumstances interfere.

We repeat, what we have stated in the preceding chapter, that care should be taken at all times to have the lower limbs of children clothed, and under no consideration of pride to permit their necks and arms to be uncovered, as it is as important that the circulation of the blood should be equal in all parts of the body as that the latter should be invigorated and increased by exercise. Danger will certainly ensue if an equal protection is not given to all parts of the body and limbs, for those parts are rendered tender and sensi-

tive by warm beds and comfortable rooms. If, while out of doors, they are not protected from the rapid absorption of heat by the circulating atmosphere, which absorption will be in direct ratio to its velocity, the consequences may be serious. The exposed parts, being thereby reduced in temperature, are enfeebled, and a predisposition to internal derangement is induced. Nor is it safe to permit exposure within doors, as even there children cannot be always protected from currents of air, which neither the most robust and vigorously constituted of them, nor even adults, can endure for a few moments with impunity.

In answer to the query that may arise, Why do children of indigent parentage endure so much exposure with seeming good health? we reply that these children are subject to exposure from birth; and the result is that those who do not possess robust constitutions are eliminated, as they die at an early age, after, in many cases, enduring great suffering, about which, owing to the obscurity of the abodes of the poor, people in comfortable circumstances know nothing. It is this fact of the indigent living away from the usual resorts of the more favored classes that partly accounts for so few little cripples being seen in the leading thoroughfares of large cities; but that their number is very far from being limited has been rendered apparent to the author during his experience in the institution over which he has control; while other reasons for their being so seldom seen are, that many are unable to leave their miserable homes, and that the industrious poor refrain from exposing their crippled children, from a praiseworthy abhorrence of

an idle curiosity too often manifested by unreflecting people. It is among these little sufferers that we usually find scrofula, in its most virulent encroachments upon the human form, and tainted with hereditary influence, the result of poverty and vice.

The hardy children we see so poorly clad, with limbs, breast, neck, and head bare, and leaving the impress of their unprotected feet in the mud or snow, have, from the hour of their birth, never known what it is to enjoy the comforts of a warm bed. Their first couch was a quilt spread on the floor, and covered with an old shawl, in which they found no warmth—*that* they only obtained when nursed in the mother's arms. Those who had the good fortune to be born in early summer were enabled to endure the winter with a single garment upon them, warming themselves, when in doors, at a little charcoal fire placed in a small portable furnace, and used for cooking a scanty meal of perhaps a broiled herring and a little coffee. But stern necessity soon drove them out into the streets and sharpened their intellect; and before they had advanced far in life, the precocious children commenced their vocation of begging, by dropping the head and extending the hand, even before they could speak plain enough to ask for alms. Thus early did they commence to earn their own living, and perchance provide for dissipated parents, which latter will even sometimes send out their crippled children upon begging expeditions, knowing that their unfortunate condition will influence the donations of the charitably disposed.

In winter, the more active of these unfortunate children will keep themselves warm during the day by

freely exercising, while at night all will huddle in lots of two or more on quilts or straw, with nothing for covering save the thin and probably wet clothes they wore throughout the day. In the summer nights, however, they fare much better by sleeping in areas and secluded places, usually seated upon the brick or stone pavement, with the back placed against the wall, the lower limbs folded under the body, the arms crossed upon the knees, and the head resting upon the arms. They generally fare very well as to diet, as they obtain bread, meat, and cold vegetables in abundance, from which they select the most palatable morsels, and, if not compelled to provide for their parents, throw the rest away.

From these facts we are enabled to derive the following valuable practical lessons: First, that to enable robust children to endure the extremes of vicissitude in our climate, it is necessary to commence at birth to clothe them very lightly and to keep them in a cold room; to let them sleep on the floor, with a blanket for bed and covering, and, as soon as they are able to take solid food, to give them cold and nourishing diet, such as bread, meat, and cold water. Children thus disciplined will not be readily injured by having the legs, arms, neck, or the whole body exposed to wind and frost, especially if they have plenty of out-door exercise. The skin will be prepared to resist the cold, or rather to accumulate sufficient heat to maintain the circulation equally in all parts of the body, which will be much assisted by active exercise. Secondly, that delicately constituted children cannot endure such plain and frigid treatment, but that they can be much

improved and invigorated by a proper modification of it. Thirdly, that robust, vigorous children will be seriously injured by being kept in warm rooms and allowed to sleep in warm beds, and by being then only partially clothed when suddenly exposed to the open air, even if it is mild in temperature; for, when thus pampered, exercise is exceedingly hurtful, owing to its direct tendency being to excite perspiration, and thus to increase the enfeebling effects of the atmosphere upon the very sensitive skin. When such children are so indulged, the air acts very directly upon the exposed parts of the body and limbs, and thereby induces inflammation of the throat, bronchia, and lungs, and, when it is the lower limbs that are exposed, bowel complaints. In fact, the whole system is frequently debilitated and impaired to such a degree that all the indications of scrofula supervene, which parents will tell you have arisen from their children having taken cold.

From what has been stated, it may be reasonably inferred that cool rooms, well ventilated, and the use of a very moderate amount of bed-clothing, will prepare the young to be comfortable with comparatively light clothing, which should be made to cover all parts of the body and limbs; and that their food should be plain and nourishing, and their exercises in the open air well regulated, and, if possible, recreative. The latter renders discipline more salutary, as it improves both the physical and mental powers, and prepares the mind for education. When the hours of study are alternated by equal periods of recreative exercises, the physical powers are not impaired by se-

dentary labor, and a vigorous, healthy adolescence is obtained.

Physical exercise, we repeat, consists in the contraction and extension of the muscles, which movement is accomplished by vital force. This force is generated from nutriment, its increase being governed by the demand for it; but this increase is not in direct ratio to the amount of nourishment taken, for the most arduous laborer, or the man of great muscular power and endurance, who can perform six hours of hard labor without ceasing and without being much inconvenienced, will, in many instances, be satisfied with less food than one who never labored a day at a time in his life, and who could not endure two hours' hard labor without actual, and, probably, very serious injury to his person. Still, if this latter person were to commence labor by working for half an hour at a time, and resting at regular intervals to recuperate, he would, in the course of a given time, be able to work for six hours without intermission with impunity, and without an increase of food.

It is, in reality, a well-established fact, that strength sufficient to meet a gradual demand is obtained without an increased call for food. The limit of strength is determined by the development and innate vigor of the organization, and requires for its augmentation gradually increased exercise of the muscular tissues. Such exercise is commonly denominated *active*, in contradistinction to that called *passive*, which latter consists of riding, etc.

Active exercise conduces to a very general and decided influence. It excites the digestive powers to

greater activity, and causes the food to be more fully appropriated to development and force. In the varied changes of temperature light and air also contribute largely to these results, by giving firmness to the muscle and resistance to the skin, and thus defend the internal organs from the injurious influence of the weather.

It must be remembered that, however vigorous the person, the animal system can not be rendered invulnerable to certain circumstances. Of this we have an example when the surface is excited to great activity and sensitiveness, as by extraordinary exercise. If the exercise which has produced that condition is not continued while a person is exposed to the full influence of a cold, damp atmosphere, the resistance of the skin will be overcome, and a most seriously injurious impression made, though the sensation may be pleasurable, and thus insidious. A fatal impress may be made upon a person who indulges in taking rest in a current of air when he is in a profuse perspiration and his system is fatigued, as the vital force is then more or less exhausted, and is subdued by outward influences.

Fatigue renders the animal system subject to many very unfavorable encroachments. A person standing in an upright position for a considerable time (which many occupations require) finds it necessary to make constant effort and exertion to sustain that position. After a time this exertion exhausts his vital force to such a degree that gravity gets the ascendency, and the circulation of the returning blood from the lower extremities is impeded for the want of such force.

And this leave to engorgement of the veins, eventuating in extensive ulceration, and to a gravitating tendency downward of the abdominal viscera, often terminating in serious derangements which require the artificial support of lace-stockings, trusses, and belts, known as abdominal supporters and affording the best means of relief in such cases. And thus we perceive that we have antagonistic forces constantly operating against the vital or living powers, and that reason and experience are our only protection against them.

Active exercises are much more valuable to the normal condition of man than passive; yet the latter are exceedingly useful to those who are unable to obtain the former, or who have not force of mind sufficient to enable them to avail themselves of the benefit of active exercise. To the valetudinarian laboring under an abnormal condition of health, and to a child or an adult suffering from a deficiency of muscular power, such as results from partial paralysis in the former or an enfeebled condition in either, passive exercise, if conjoined with agreeable pastime in the open air, and with the body properly protected by clothing, will be of great advantage in the promotion of health and vigor; while persons laboring under indigestion and feeble appetite will derive marked benefit from a drive in an open carriage or a ride on horseback through some beautiful scenery. Thus diversion and exercise will be given to the mind at the same time that motion is given to the circulating system, and mental despondency and bodily infirmity will be equally relieved.

Exercise exerts the most salutary influence an hour or two after taking food. Whether it be active or

passive, it equalizes the excitement throughout the system, but it more especially determines the vital force to the surface and limbs, and it thus retards the digestive process, which requires a concentration of that force in the stomach, and in direct ratio to the ability of the digestive organs to digest food. Hence it is that we are dull and sluggish after partaking of an over-hearty meal, when there is a concentration of vital force, or an effort of nature to relieve itself of the excessive burden. If this effort is interrupted in its process fermentation ensues and produces much inconvenience to the person and actual injury to the system.

Special exercises for the increase of power, having for their object the direction of the vital forces to partially paralyzed limbs, are of great value as remedial agents. Motion, carefully and perseveringly imparted, often results in the restoration of muscular power. But the practice requires a skilful discernment of the innate powers, with the exercises regulated accordingly; otherwise the latent spark may be exhausted, or the whole muscular system may be lessened in its ability to accumulate power, from injury being sustained by an excess of rubbing or of passive exercise in treatment which is often practised upon children who are unable to walk after the expiration of the ordinary age, or who are laboring under partial paralysis. Such cases require very special care, as the mechanical support should be gradually dispensed with as the energy increases.

Excessive exercise destroys all tendency to a restoration of lost power; while a uniform continued sup-

port, by being a substitute for the natural powers, arrests the progress of cure. And this should teach us how necessary it is that an experienced and skilful practitioner should be employed to prescribe a judicious course of treatment by the adoption of the most reliable means, in which recourse should be first had to exercise by passive motion, which should be followed by the appliance of surgico-mechanical apparatus that will support the body in an upright position. Such a course of treatment will induce a disposition to progressive movement, and cause the *will* to have a most salutary influence upon the muscles by inciting effort, and thus naturally determining power to the deficient parts, whether those parts be one or more of the limbs of an adult or a child. Still the progress towards cure will be slow; yet we have the gratifying assurance, from precedents, that, in cases of deficiency of power in children, they are nearly all curable when they are judiciously treated. The tendency to growth contributes largely to the cure; but the constant disposition to restoration of power in the muscles, if not properly guarded against, will, instead of a cure, produce one of those extraordinary cases of deformity that are so often witnessed. This is attributable to the larger muscles receiving power first, and exerting it to the detriment of the lesser, which are more numerous, and are weakened in direct ratio as the stronger contract, and keep the antagonistic muscles extended, and thereby destroy their tendency to recuperate.

The treatment requires special attention to obviate continued extension which promotes absorption,

whereby the muscles diminish in size, and thus prevent a possibility of establishing the wonted muscular action, which is contraction and extension. For the want of this motion, even the large muscles, that first contract, will diminish in size till they become mere cords; while the want of motion in the joints will cause the membranes around the joints to conform to their contracted shape and fix them in their deformity. Yet, in these extreme cases, surgical skill will often restore children who are so seriously afflicted to the use of their limbs.

Children born with club feet have their legs and feet as fully developed as those of well formed children. It is only after they are enabled by their own strength to sustain themselves in an upright position that the leg below the knee diminishes in size; and, as they grow older, it becomes reduced to mere tendons, skin, and bone. The foot being fixed by its contortion, the ankle joint is deprived of motion, while at the same time the muscles of the sides, back, and front of the leg are deprived of their wonted motion. The continued extension induces absorption and diminishes the muscular fibres, as they are not required for use. These facts indicate that motion requires contraction and extension of muscles, in order to sustain every part of the animal system in its integrty; for, as soon as the surgeon divides one or more of the fixed tendons that arrest muscular motion, active exercise is soon practicable, and the leg increases in size. Then, a certain limited amount of exercise will maintain the muscular system in ability to be invigorated: but strength can only be acquired by well

regulated but frequent exercise, for, if the muscles are not kept in motion, they will fail to become developed and to accumulate vigor. And thus all restraint to the free action of muscles should be carefully guarded against. The blacksmith, who wields the heavy hammer with his right arm, develops the muscles of that arm to a much larger size than those of his left; and their size is not only increased but their red color is heightened, showing that there is the greatest amount of blood distributed through the muscular fibres of those muscles that are most exercised.

From these statements we are naturally led to conclude that an integral part of the body, if deficient in muscular power, may be improved by special exercise; and that, when all parts are in a well developed and vigorous condition, they may be maintained in that state by exercising them equally, and as much as possible at the same time; but if this latter is not possible, as is the case in the pursuance of certain trades, then persons should avail themselves of general exercise for the purpose of maintaining a healthy condition. To this recommendation it is not improbable that a most ready excuse will be offered, "We have not time." It is the excuse of the laborer, the mechanic, the tradesman, the artist, the merchant, and the man of science, and it invites our attention to another variety of exercise—that of the mental faculties. With the mind brought to a proper state of discipline, such an excuse will not be made.

CHAPTER IV.

MENTAL AND PHYSICAL EXERCISE.

Mental and physical powers must be exercised equally to insure longevity—The effect of such combined exercise on different classes—Suggestions for the social improvement of laboring men—The greatest amount of work is not achieved when the entire time is devoted to labor or study—Gloomy forebodings prejudicial to health—The effects of constant excitement—Traveling, the best exercise—The beneficial influences of a sojourn in the country—When mountain air should be avoided—The influence traveling exerts upon the mind and body—How travelers should be clothed—Ill health the result of moral causes—Disorganization of the brain and spinal marrow, and its treatment—The effects caused by exposure to rapidly moving air—Persons should be careful in giving advice to valetudinarians.

THE largest amount of labor ever performed by man has been accomplished by those persons who exercised their mental and physical powers equally; but they kept themselves under complete self-control, and thus found time for all they desired to do. This, however, they attained by systematically dividing their time, and by disciplining themselves to a strict adherence to the rules they laid down for their observance. By this means they found time for study, and time for physical exercese or labor; and they were further rewarded by a long lease of life, for longevity is insured by an equal exercise of mind and muscle. We have many examples of this in the

lives of HUMBOLDT and other naturalists, who have traveled over the most inaccessible portions of the earth in search of their objects of study, who have subjected themselves to the most arduous labor in journeying on foot, in carrying immense loads of specimens, and in climbing up mountains and over rocks and underbrush, and who have exposed themselves for weeks to climatic and other influences most inimical to health. Dr. R. R. MADDIN, in writing upon the "Infirmities of Genius," furnishes a table of the relative average longevity of eminent men in various pursuits, and shows that natural philosophers stand at the head: the united ages of a certain number of these amounted to 1494 years, giving an average of 75 years each; while the united ages of a number of authors and poets amounted to 1300 years, giving an average of only 65 years.

With these data to guide us, we are enabled to draw deductions that give us a very clear perception of the most salutary influences that mental and physical exercises exert upon man when they are properly combined.

Pursuits of pleasure often involve an immense expenditure of labor, which is sustained by some persons without apparent fatigue, while others, who even possess stronger muscular development, become exhausted under like circumstances, and actually receive injury. In the latter, there is an expenditure of muscular strength while the mind is inactive, as is the case with the day-laborer, or with one who has only an interest in the sum he is to be paid for his work. If he is poorly paid, and is depressed in mind, his

desponding disposition will lessen his lease of life; but not to the extent that will be experienced by the person who exerts his mind more than his body, or, by the merchant who is subject to anxiety. Those who exercise the mind, even pleasurably, and either avoid or can not find time for physical exertion, are the shortest lived of all; and their lease of life is in inverse ratio to the extent they yield to self-inclination, and avoid proper discipline.

The author, the poet, and all persons of sedentary occupation, should not fail to set apart a time wherein to relieve the mind by varied and agreeable pursuits in which the muscles can be exercised and the mind refreshed. This is not so difficult a matter as persons at first imagine. Severe physical exercises must, however, be gradually entered upon, or they may prove seriously injurious instead of being most salutary, as they would be after careful inurement.

For the laborer, rooms should be provided for social converse, for reading, and for instruction by lectures on social government and economy. Such institutions ought to be established and sustained by the public, as they are as necessary for the good of society as public schools, and they should be supplied with well-selected reading. In these institutions, the laboring man, when able, should be induced to make a deposit of a small portion of his earnings, which deposit should be invested for his special benefit, and returned to him, with interest, when he needed the amount. No part of it should be expended in the support of the institutions. If this plan were adopted, it would be an incentive to the laboring classes to avail them-

selves of the mental privileges and pecuniary benefits such institutions would afford them; while the knowledge that they possessed a hoard, to which they could resort on what is popularly termed "a rainy day," would have the effect of diverting their minds from gloomy prospects, and make them intelligent and happy, and would thereby contribute largely to their social well-being. At present, the only resorts of day laborers, for pastime and relief from their gloomy thoughts, are the small groceries and drinking shops, where they meet with low politicians, who debase their minds by their vile machinations. By the method proposed, these laborers would be enabled to exercise and improve their minds, and they would thus equalize the expenditure of their vital forces, and find the benefit of so doing in the improvement of their moral and physical condition. Nearly all other classes of men who are disposed to avail themselves of what is beneficial and conducive to their happiness, possess the means whereby they can acquire such gratification; but it is not so with the poor laborer, who is limited by stern necessity to his present condition; and it is in consequence of the degrading character of this condition, and with a desire to advance his social position, that we are led to offer these suggestions for his amelioration.

The avaricious may be assured that it is not by devoting the whole of their time to labor, be it either in the exercise of their physical or their mental powers, that they will achieve the most. By an equal division of time, alternating bodily and mental labors, or interposing periods of rest or pleasur-

able pursuits, an interim is obtained for the accumulation of energy of muscle or mind; while, on the contrary, by a wearied perseverance the energies are worn out and confused, and the powers of the animal economy are destroyed, for they soon fail from exhaustion if they are not relieved. This is an inevitable result.

Gloomy forebodings tend strongly to indispose persons to labor or take exercise, for the want of which ill health ensues. To obviate this additional calamity, exercise should be sought that is calculated to engross the mind, even if it is unprofitable in a pecuniary point of view. Occupation is, in such cases, the best and only means of making a desperate resistance to the impending danger. This conservative principle is well understood by talented generals in charge of armies suffering from reverses; for, when actively engaged in resisting an enemy, they maintain good health, even if the struggle is continued for an extraordinary time. The Greek army, under the command of the Athenian general, XENOPHON, in its extraordinary retreat of two hundred and fifteen days of toil and contention, lost scarcely a life by sickness. On the morning after the fearful night that succeeded the murder of CLEARCHUS and the other leaders of the great army, by which XENOPHON was left alone to conduct it through a perilous retreat, the young general addressed his comrades in this strain: "The soldiers have, at present, nothing before their eyes but misfortune; if any can turn their thoughts into action, it would greatly encourage them." The suggestion was soon acted upon, and the men were

encouraged to resist to the death rather than submit to capture. Every thing was destroyed that could be an encumbrance; and the march was commenced, with the enemy in front and rear. It is stated that out of about ten thousand men, not over five hundred were lost; and these only by such casualties as being mired in swamps, marshes, etc.

Constant excitement often sustains delicate persons in extraordinary endurance. This most conclusively proves that a determined will, which demands constant exercise of both body and mind, impairs the system much less than the extraordinary exertion of the one without the balancing influence of the other. Still, the alternating of mental and bodily exertion with pleasurable entertainment is the most conducive to good health and longevity.

The most efficacious of all exercises for those who can afford the time and means, is traveling. It far surpasses a sojourn at the springs, as it furnishes both active and passive exercise, with the addition of mental diversion. The latter is derived from the survey of new scenery; not artificial, like that witnessed in our great cities, but of natural formation that far excels the work of man. And the mind is charmed by its endless diversity—at one time impressed with pleasure by the miniature beauty of some umbrageous dell, and at another moved to rapture by the sublime grandeur of some towering height or of some teeming cataract—while the exhilarating atmosphere, especially in the mountain ranges, increases alike mental vigor and physical strength.

The stimulating quality of the atmosphere in moun-

tainous regions exceeds that of the air in any other district in its salutary influence upon invalids of enfeebled mind and body—a most numerous class in our large cities. Such persons should take their offspring with them into the country, and leave them there for a time after their return to town. In fact, if it were possible to accomplish it, it would contribute largely to a vigorous manhood if their children were to reside in the country for two or three months during every year of early life. But a residence in a mountain region should be avoided in every case where there is an irritable condition of the lungs, and more especially if the derangement has extended to congestion of the mucous membrane and a secretion of purulent mucus has supervened, with periodical paroxysms of coughing, as, for instance, coughing severely after rising in the morning or upon retiring to bed at night; for, under these circumstances, the stimulant effect of the atmosphere in such a region would increase the irritability and hasten ulceration of the substance of the lungs. All persons, young or old, who are thus afflicted should avail themselves of a soft, warm atmosphere in a tropical climate, traveling in which often proves most decidedly beneficial—much more so than a residence in a variable climate for any length of time.

The constant employment of the mind and the muscular system under the force of the will, when conjoined, as it is in traveling, with passive exercise, induces a decided tendency to restoration of power; for in this instance gradual exercise increases the ability to generate strength sufficient to meet the de-

mand, and leads to the whole system being invigorated by the combination of exercises. Hence it is that persons who have been enfeebled by disease, and who after confinement to the house for months have supposed themselves unable to take out-door exercise, have felt themselves much invigorated and their appetite sharpened by a few hours' ride, and have found their strength and vigor to be almost restored after a few days' traveling.

A change of locality is generally of benefit to invalids, but in its restorative effects it bears no comparison with a course of travel in coaches or on horseback. These means of conveyance afford far greater benefit than can be derived from steamboats and railroads, yet traveling on the latter often gives much relief to persons laboring under long-continued ailment. A train of new ideas are induced, and these dissipate the desponding passion which has usurped the control of the mind. And the relief thus afforded exhilarates the whole system, and prepares it to be much benefited by activity of the muscles, which alone can increase the velocity of the circulation and create a demand for nutriment.

Persons of a highly susceptible disposition—those who readily take cold, or who by very slight exposure suffer from rheumatism, neuralgia, and other predispositions to disease—are, after a few days' travel, enabled to bear most extraordinary exposure, and can endure rain, cold, and fatigue without sustaining the least injury. This is a direct proof that the system acquires vital resistance from the activity that is engendered by the invigorating effect of the fresh air,

and from the increase of the circulation of the blood that is created by muscular motion. Almost the first indications of improvement in health are an apparent serenity and mildness of disposition, which is in happy contrast to the temperament previously manifested.

The exercise of traveling induces rapid secretion from the surface of the body; so much so, indeed, as to produce torpidity of the bowels. Consequently, tourists will derive great benefit from cleansing the body with soap and warm water once every twenty-four hours, if possible. The practice will amply repay invalids by improved health for any inconvenience it may cause them. Travelers should invariably clothe themselves with flannel undergarments; if the weather is very warm they may be of gauze flannel, and of thicker material as the temperature decreases. If the traveler in pursuit of health will follow these instructions he will be benefited quite as much, if not more, than he would by undergoing treatment at any water cure establishment in the country. In addition to the advantage he will derive from the favorable influences of traveling, he will have the skin restored to the wonted performance of its normal functions—which are invariably at fault in persons laboring under continued ill health—and the mind restored to its normal condition by the dissipation of all gloomy forebodings.

A large amount of suffering from ill health has its origin in moral causes—in the over-exertion of the mind, whether it be produced by the pleasurable excitement attendant upon prosperous business pursuits, or whether it spring from sorrowful sources. In either case if the excitability is excessive it is supported at

the expense of the digestive and muscular systems, enfeebling them and producing a morbid derangement that reacts and produces depression of the mind from painful sensations. In the catalogue of these sensations, we have indigestion, rheumatism, neuralgia, and not unfrequently disease of the heart, which latter terminates in sudden death; as well as softening of the brain, resulting in imbecility, or of the spinal marrow, terminating in a gradually increasing paralysis.

In the disorganization of the spinal marrow, the first indication is an inability to raise the foot without rendering the step insecure; after a time this is succeeded by an inability to walk without support, and then there is a failure of the muscles about the throat, even to a difficulty of swallowing. When this is accompanied by softening of the brain, a gradual failure of the mental faculties ensues, with paralysis. Persons thus afflicted, when exposed to a cold, damp atmosphere, are more enfeebled for the time, the effect being very like that which aged persons experience from cold. The system fails to afford resisting excitement sufficient to compensate for the loss of heat from the conducting properties of the air, which under this peculiar condition is a rapid absorbent of the natural heat of the body.

Rest for the mind in a dry, bracing atmosphere, well charged with electricity, such as is usually found in mountainous regions during the summer months and in dry weather, is of great service to sufferers from these ailments, and to feeble, aged persons, especially if passive exercise, such as is obtained from riding on horseback or in an open carriage, is at the

same time taken. But under no condition should they allow themselves to be subjected to a concentrated draft of air, nor should they take shower-baths or bathe in cool, running water. By either of these the system would be deprived too rapidly of its vital energies, and torpidity would be produced; for when thus afflicted, there is an inability in the system to recuperate its energies, which it is enabled to do when in good health. Still, the very desirable ability of the system to accumulate excitement may be induced by careful and proper exercise in traveling, for then the mind is most likely to be relieved by diversion. When traveling will not lead to that result, there can be but little benefit derived from leaving home.

Rapidly moving air or water deprives the animal system of its heat, and consequently of its vital energies, in direct ratio to the velocity of movement and frigidity of temperature. And thus it is that feeble persons, upon being exposed to a pleasurable breeze of air in a confined space, acquire what is commonly called a cold. The concentrated draft overpowers the vital energies of the system, and deranges its natural functions, and most frequently its secretions, especially those of the mucous membranes. It leads to the secretions being not properly elaborated, and consequently induces an irritation which excites the membranes to excessive action. Air, *per se*, is not a good conductor of heat. Exposure to a dry, quiescent, and even a cold atmosphere, say to one of 32° of Fahrenheit, is not injurious, if the body, by its own muscular power, is kept in motion during the exposure; in fact, the electricity that the air affords to the system when thus exposed

is decidedly beneficial, owing to its stimulant nature.

Delicate persons should avail themselves of exposure to the free atmosphere, whenever they are enabled to do so without producing much chilliness when warmly clad. Such exposure, however, must be regulated to the condition of a person's health and recuperative powers, which is the only true index to the ability to resist extraordinary influences. It is beyond the power of any one to state, from casual appearance and without an intimate experience, what amount of endurance another can sustain without injury; therefore, persons should by no means persist in advising valetudinarians to do what may have proved beneficial to themselves, as the difference in ability to sustain the system and to improve it by the same course of practice would in many instances lead to its being pernicious and decidedly injurious.

CHAPTER V.

MEANS OF RELIEF IN CASES OF ACCIDENT.

Importance of timely aid when an accident occurs—Wounds and their treatment—Suspended animation from drowning—Suffocation from foul air—Suffocation from common burning-gas—General rules to be observed in cases of suffocation—Suffocation by choking—Suspended animation from cold—Extensive burns or scalds—Syncope or fainting—Poisoning.

IN all cases of accident, whether they be trivial or serious, much painful suffering may be averted, and even the life of the sufferer may be saved, when timely aid is afforded. Consequently it is important that all persons should possess a knowledge of what should be done in every case of emergency, as a familiarity therewith seldom if ever fails to prompt the good Samaritan, or the first to discover an injured person, to apply the proper means of relief. The subject, it is true, scarcely comes within the scope of this work; but we are impressed with the belief that a chapter pointing out the best ways of affording such relief, can not fail to add to its utility.

A thorough determination to afford relief is all that is wanting to nerve the most timid person to attempt the alleviation of a suffering fellow-creature, especially when such person possesses the knowledge of what to do, and no other assistance is at hand; and where in-

experienced persons can be called upon to render assistance, the advice of one thus informed can be of great and precious value. It can not fail to be a source of sad reflection when persons discover that, had they been acquainted with the proper course to pursue immediately after an accident had occurred, a knowledge of which they might easily have attained, their own services might have saved the life of a husband, a wife, or a child. We therefore earnestly impress upon all a careful perusal of the following instructions in order that they may be enabled to render efficient assistance whenever any unforeseen calamity may call their services into requisition.

Wounds and their treatment.—Probably nothing is more frightful to a person unaccustomed to witness accidental injuries than the sight of bleeding wounds; and more especially so when the spectator possesses a knowledge of the circulation of the blood, for he then views with alarm the crimson stream darting forth in pulse-like jets. But a knowledge of what should be done, and a feeling of responsibility, will almost immediately react upon fear and prompt a person to make an effort to arrest the bleeding by hastening to obtain a compress; and when nothing else can be found for the purpose, it is recommended to tear off a portion of an under-garment and fold it carefully into a compress, not over an inch and a half square and at least half an inch thick, with a penny or chip enfolded in it so as to increase the firmness.

When blood flows from an artery, the compress must be placed not on the lacerated parts, but on the artery running parallel to the limb, and about an inch

from the wound, in the direction of the heart, by which means the bleeding vessel is compressed between the heart and the wound, and the flow of blood stopped. The arteries convey the blood from the heart to all parts of the body, and bleeding from them can only be arrested by pressure made between the heart and the wound. The compress being properly placed, a folded handkerchief must be wrapped over it and round the limb, and firmly tied; after which a stick must be passed beneath the knot, and then, by twisting the stick, a sufficient pressure will be obtained to arrest the bleeding. This being accomplished, a surgeon should be sent for in all haste.

A wounded vein, from which will flow dark red blood, may be secured in a similar manner, with the exception that the compress must be placed on the wound, as venous blood flows to the heart. Bleeding from a vein is much more readily arrested than that from an artery, and in most instances, cold applications are sufficient for the purpose.

Suspended Animation from Drowning.—Accidental drowning is the next most serious casualty that occurs in families; but in many cases pending death may be averted by prompt and persevering effort. It is only where a person has been under water for twenty minutes that resuscitation becomes doubtful. If the patient is warm about the chest, and the pupils of the eyes contract by exposure to a bright light, the case is most hopeful, and should encourage continued exertion for hours, for persons have been restored to life after four hours' effort. The greatest success attends those cases in which there is an early application of the proper

means of resuscitation, with which every body should become familiar, and which are so simple, and a knowledge of them so easily acquired, that the most dull of comprehension can readily be taught what to do in a case of emergency.

The first effort to be made after recovering a body from the water is to place it on a table or board, stripped of the wet clothing, with the face downward and beyond the end of the board. The head must be supported with one hand placed on the forehead, while with the other hand an endeavor must be made to draw out the tongue on one side of the mouth; after which the mouth and nostrils must be cleansed from adhering mucus or other obstructions to the air-passages. Gentle pressure made once or twice upon the back will cause any mucus or fluid to flow out of the mouth. As might be supposed, the lungs do not become engorged with water, so, at most, only a small portion will flow out. By this means the air-passages will be cleared. When this is accomplished, and it ought not to occupy over a minute, the body must be turned upon the back, with the shoulders and head moderately elevated. The tongue must then be drawn more forward so as to project from the mouth, and the arms must be taken hold of at the elbows and moved forward and upward until they nearly meet above the head; after this, the arms must be brought down to the sides of the chest, compressing the sides, and with the hand the lower portion of the breastbone; then the chest must be freed of all pressure, and the arms raised as before, repeating the process about twelve times in a minute.

That the temperature of the body may be increased, warm blankets and friction with warm cloths must at the same time be perseveringly applied to the body and lower extremities; and hot water, not quite scalding, must be sprinkled on the chest and face occasionally. Also, smelling-salts or hartshorn should be applied to the nostrils until natural breathing is established; but when these are not at hand, burning matches are recommended, but they must be used very carefully, or the sulphurous fumes will be injurious.

When respiration or breathing is restored, most careful watching will then be absolutely necessary, and, with the following treatment, must be kept up for many hours:

First, the patient must be removed to a firm, comfortable bed in an airy room, the head and shoulders elevated to an almost sitting posture, and the body covered with warmed blankets; then bottles of hot water must be applied to the thighs, arm-pits, and feet, and mustard-poultices to the abdomen and calves of the legs; and friction with hot flannels or other cloths must be kept up upon the arms and legs, to improve and maintain the circulation, which will be feeble. This treatment must be continued as long as the pulse continues weak.

Stimulants and nourishing food are not admissible. Ginger tea and other warm drinks are beneficial, and only light diet must be given until the patient has recovered from the effects of the accident. The brain will be more or less oppressed from the impure blood that will be thrown upon it, in consequence of the lungs having failed to perform their office of purifica-

tion, and, therefore, stimulants or very nutritious food might increase the derangement.

Suffocation from Foul Air.—Accidental suffocation most frequently occurs in families through a want of knowledge in regard to the burning of charcoal in a close room during very cold weather. The emanation from the burning coal is *carbonic acid gas*, a most deleterious air, which, from being generally void of smell, is very insidious in its effects. A lighted candle will indicate the presence of this foul air in a room, by burning very dimly, and it will cease to burn if the gas is in great excess. This is a test for the presence of the same gas in caves, pools, wells, etc., where it is generated from other sources than that of burning charcoal.

When this gas is in great excess, as it almost invariably is in wells or cesspools, its effect is to instantly overpower a person exposed to it. But where it is gradually developed, as in the case of burning charcoal in a room, the first effect is a slight dizziness and an inclination to sleep; and this is followed by an oppressive feeling in the head, by impure blood being carried to the brain, by stertorous breathing, and, finally, by a deadly sleep. The person then becomes motionless, and at times apparently stiff, but it is not always so; still, the warmth of the body usually remains natural for several hours.

The means of relief to persons insensible from the effects of carbonic acid gas, from whatever source, consists in at once removing them to an open exposure of pure air; in having them stripped of their clothing, and in placing them so as they can be most readily

handled, laying them on the back with the shoulders and head moderately elevated. The arms and chest must then be exercised in the manner employed for restoring respiration in persons partially drowned, and the subsequent treatment must be the same as that adopted in such cases.

Suffocation from common Burning-Gas.—The gas used for lighting our dwellings is *carburetted hydrogen.* When it accidentally escapes into a bed-chamber or nursery, it is exceedingly deleterious to the occupants, and will explode with great violence if the room is entered with any kind of flame. Therefore, whenever the gas is suspected to be escaping, all lights should be extinguished, and all the doors and windows of the apartments thrown open, when they will be cleared of gas in ten or fifteen minutes. Should there be any suffocating persons in the rooms, they may be removed with impunity by those entering without a light, as soon as the doors can be opened. Persons under the influence of this gas should be treated in a precisely similar manner to those suffocated by carbonic acid gas.

General Rules to be observed in cases of Suffocation.—In all cases of suffocation, the first effort to relieve the person is to supply the lungs with pure air, and by the best possible means alternately to inflate them and to expel the air from them. It has been demonstrated that, by elevating the arms above the head, and by then pressing them against the sides of the chest, and at the same time pressing the lower portion of the breast-bone, the first movement will cause the greatest possible amount of air to enter the lungs, and the

second will cause the most perfect expiration of it to be accomplished, provided that the tongue is drawn forward.

Manipulation, friction, and stimulant applications should be employed, even to in a slight manner scalding the extremities, and, in desperate cases, the spine; in fact, an effort should always be made to keep the body and limbs warm, and to warm them if cold. The head should be kept elevated, so that the impure blood may flow the more readily to the lungs, in order that it may be purified by the pure atmospheric air, which should be admitted into the room freely, even in cold weather, opening the windows if necessary.

Suffocation by Choking.—All cases of suffocation, even those of suspension by the neck, should be treated upon the principles here stated; as also should cases of choking or suffocation from an attempt to swallow too large a portion of meat or other substance, after the obstruction is removed from the throat. For this latter purpose, it is necessary to examine the back part of the mouth and down the throat as far as possible. If the substance is just out of sight, it may be detected and often removed by the finger; or a pair of forceps may be directed to the place, guided by a finger of one hand, and the obstruction removed with the other. When the substance is large and not far down, it may also be extracted with a hook guided by the finger, or it may be forced out of the throat by slapping the person on the back, the body being at the same time thrown forward or elevated by the feet, head downward. However, the latter treatment

must not be continued if it is not immediately successful. If the obstruction is far down the throat, a piece of strong whalebone or ratan notched near one end, and a firm bulb of cotton covered with woven material tied firmly to it and smeared with any grease at hand, must be used to dislodge the substance by forcing it into the stomach with the end so prepared, employing prompt and decided force.

Suspended Animation from Cold.—Continued exposure to cold beyond an ability to resist its influence, at first produces a painful sensation, with numbness of the extremities; then follows a calmness and an irresistible inclination to sleep, and finally unconsciousness.

A person, when found in this state, should be wrapped in a blanket with the head uncovered, and conveyed to a house, where the clothes should be removed in a cold room; the body and limbs must then be rubbed briskly with snow or iced water for a minute or two, after which they must be wiped with cold, damp towels, dipped at first in spring water or water that is not frozen, and then in water the temperature of which is gradually increased to that of the natural heat of the living body. When the skin is improving in temperature, the patient must be placed in a cold bed and covered with a blanket, and the lungs must be inflated as before described in treating of suffocation from drowning. After recovery, the patient must be kept in a cool room comfortably covered. If the extremities are actually frozen, continue to occasionally apply to them cloths dipped in cold water, and be very careful not to use any warm applications; if thus

treated, they will, in most instances, be restored to a normal condition. In some instances, however, the toes, fingers, and ears may be past entire recovery, and even the death of them may ensue; under such condition, a skillful surgeon alone can be relied upon.

Extensive Burns or Scalds.—It must always be borne in mind that, if a burn or scald extends over much surface, especially about the neck, breast, or upper portion of the chest, the accident is dangerous, and in proportion to the depth and extent of the injury. With some it is customary to apply cloths wet with cold water to the injured part; but such a procedure may be almost fatal in the case of an extensive burn, as it will create a shivering which will rapidly exhaust the nervous energy. Exposure to cold air produces a similar effect. The proper course to pursue is to cover the surface as quickly as possible with some emollient application, and for this purpose molasses and raw cotton have been used with decided benefit; yet muslin dipped in molasses will answer a similar purpose. One good quality that molasses dressing possesses is, that it can be readily removed when necessary, owing to the molasses being very soluble in warm water. Another good application is an embrocation made by mixing equal parts of linseed oil and lime-water, into which cloths must be dipped and applied in divided portions; for the whole surface of an extensive burn should never be exposed to the effect of the air, which is extremely irritating to the denuded surface; besides, when an extensive raw surface is exposed to the painful influence of the atmosphere, the vital energy of the system is most rapidly exhausted.

Too much care can not be taken to preserve the strength and energy of the patient, and, therefore, frequent dressing must be avoided as much as possible, and, when being dressed, only a small portion of the inflamed surface must be uncovered at a time, invariably re-covering one portion before exposing another; while the patient, if so disposed, must be permitted to take rest before the whole is completed.

A new application has lately been introduced and much praised for its soothing and healing qualities. It is as follows: "Take chalk and linseed or common olive oil, and mix them in such proportion as will produce a compound as thick as honey; then add vinegar so as to reduce it to the thickness of treacle, (molasses;) apply with a soft brush or feather, and renew the application from time to time. Each renewal brings fresh relief, and a most grateful coolness. If the injury is severe, especially if it involve the chest, give ten drops of laudanum to an adult, and repeat it in an hour, and again a third time. To a child of ten years, give in like manner only three drops, and beware of giving any to an infant. This plan, with an internal stimulant according to age, as brandy or sal-volatile, (carbonate of ammonia,) or both, should be at once adopted; and there need be no impatience for the arrival of the often distant doctor."*

As it regards the doctor, his presence should be procured as soon as possible.

When extensive burns are healed, the tender new skin inclines to contract, whereby it produces great

* Braithwaite's Retrospect, part xlvii. p. 162, 1863.

deformity. This, however, may in a measure be arrested by keeping the injured parts covered for months, or even a year or more, with oiled silk, and by frequently anointing the parts with stramonium ointment, which can be obtained from an apothecary, or is readily prepared by stewing the green leaves of stramonium in lard.

Syncope or Fainting.—Persons subject to fainting frequently give much alarm to others not familiar with the ailment, which, after all, is of but little consequence to those susceptible to it. But persons who faint from exhaustion, fatigue, long fasting, violent passion, severe pain, some frightful scene, or from extreme anguish, require immediate attention. The usual appearance in such cases is a deadly paleness accompanied by insensibility, while the eyes become dim, the hearing is gone, a deep guttural groan escapes the lips, the pulse stops, the breathing is imperfect, and the voice fails. This condition must be relieved as soon as possible; and to accomplish it, the patient's clothing must be loosed and the body extended on the floor without elevating the head; the face must then be sprinkled with cold water, and, if convenient, the temples and about the mouth must be bathed with vinegar, while a little vinegar and water must be given to drink, or be put into the patient's mouth; in addition, the feet and hands must be sharply slapped, and smelling-salts applied to the nose, but not too constantly. These means, if persevered in, will usually relieve, when a gentle stimulant, such as spirits of camphor or brandy, should be administered.

Poisoning.—When persons in perfect health are sud

denly attacked with sickness after partaking of food, and especially if the food has had a peculiar and unusual taste, and when the sickness increases in violence and is attended by excessive nausea, by a burning sensation in the throat, by a disposition to continued vomiting without the ability to vomit freely, and by a sense of suffocation, giddiness, or unusual drowsiness, it may reasonably be concluded that they are laboring under the effects of poison.

In violent attacks of ordinary ailment, there is usually some premonitory symptom or known cause, as, for instance, over-indulgence in eating some unwholesome food; but in such cases the nausea and vomiting are unattended with a burning sensation in the throat; nevertheless, there may be severe pains and cramps, but they are usually relieved by anodynes, stimulant applications, or emetics.

Emetics are nearly always admissible in cases of violent attacks of pain in and sickness of the stomach. In fact, emptying the stomach is the first thing to be done when poisons have been taken; and for this purpose the stomach-pump is invaluable, but it is only the physician who can use it successfully. Still, much may be accomplished by employing the means at hand to produce vomiting, the most effective of which is to freely give the patient salt dissolved in warm water, about a table-spoonful of the former to a pint of the latter, or instead of the salt, a similar quantity of mustard; and this failing, the finger or the feather-end of a quill should be put down the throat. In a word, any thing that will excite vomiting may be used, and more especially if the case is that of a child who

has been poisoned by eating poisonous seeds or berries; for if they are thrown off, much relief will thereby be afforded.

When much prostration or drowsiness supervenes, fresh-made, strong, pure coffee, without milk or sugar, should be given freely, and the patient kept moving till the arrival of the doctor, who, when sent for, should be requested to bring the stomach-pump with him.

Antidotes for poisons can, with rare exceptions, be used only by skillful physicians; for the prescribing and advising of their use by inexperienced persons is only hazarding the lives of the unfortunate. Yet we repeat, in all cases of poisoning much good may be done before the doctor can be obtained, even to the saving of life, by the prompt administration of an emetic and the causing of immediate vomiting; and by such action the patient may even be out of danger before he arrives; yet under no consideration should any thing be allowed to prevent his being sent for the moment it is discovered that poison has been taken.

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